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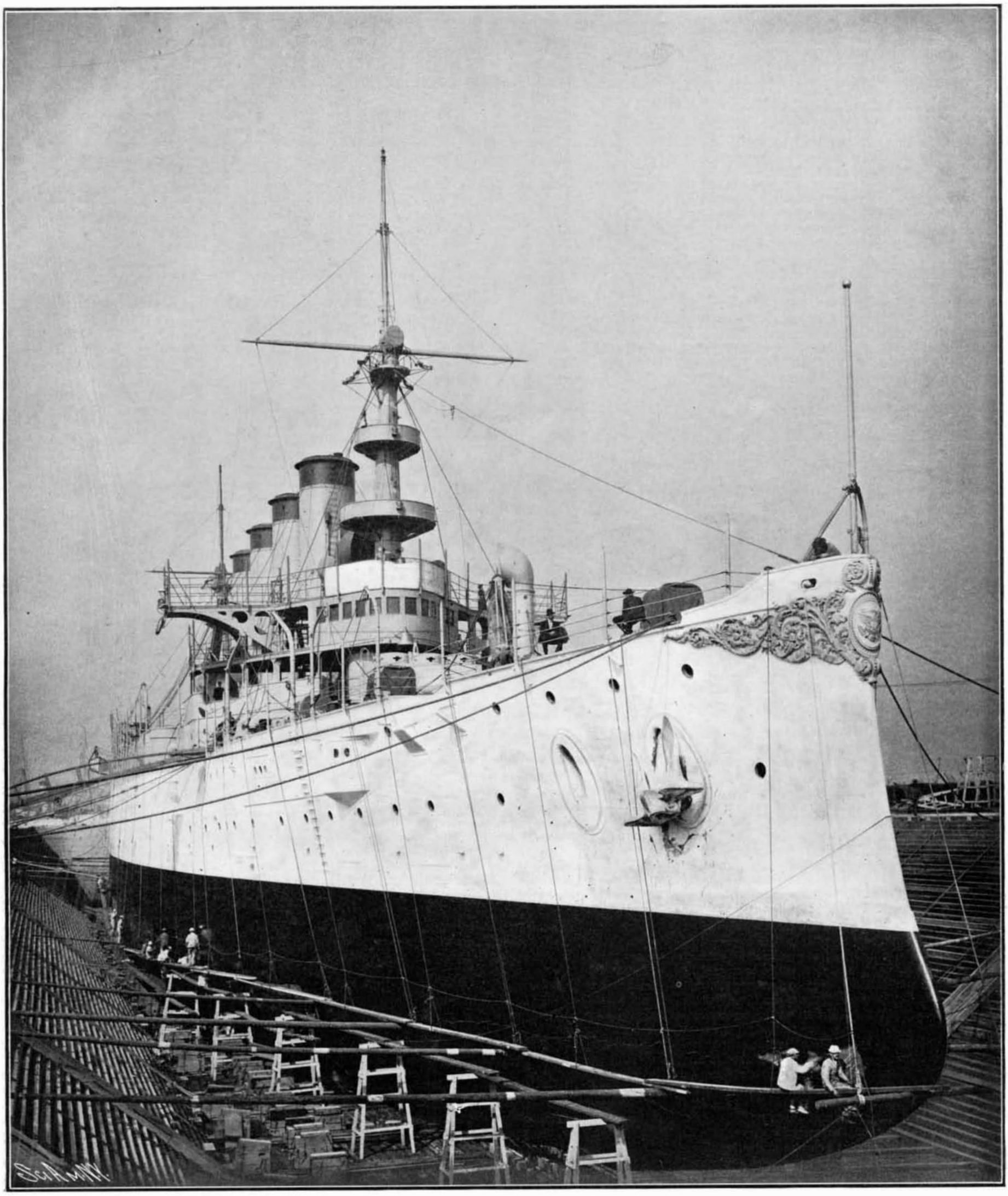
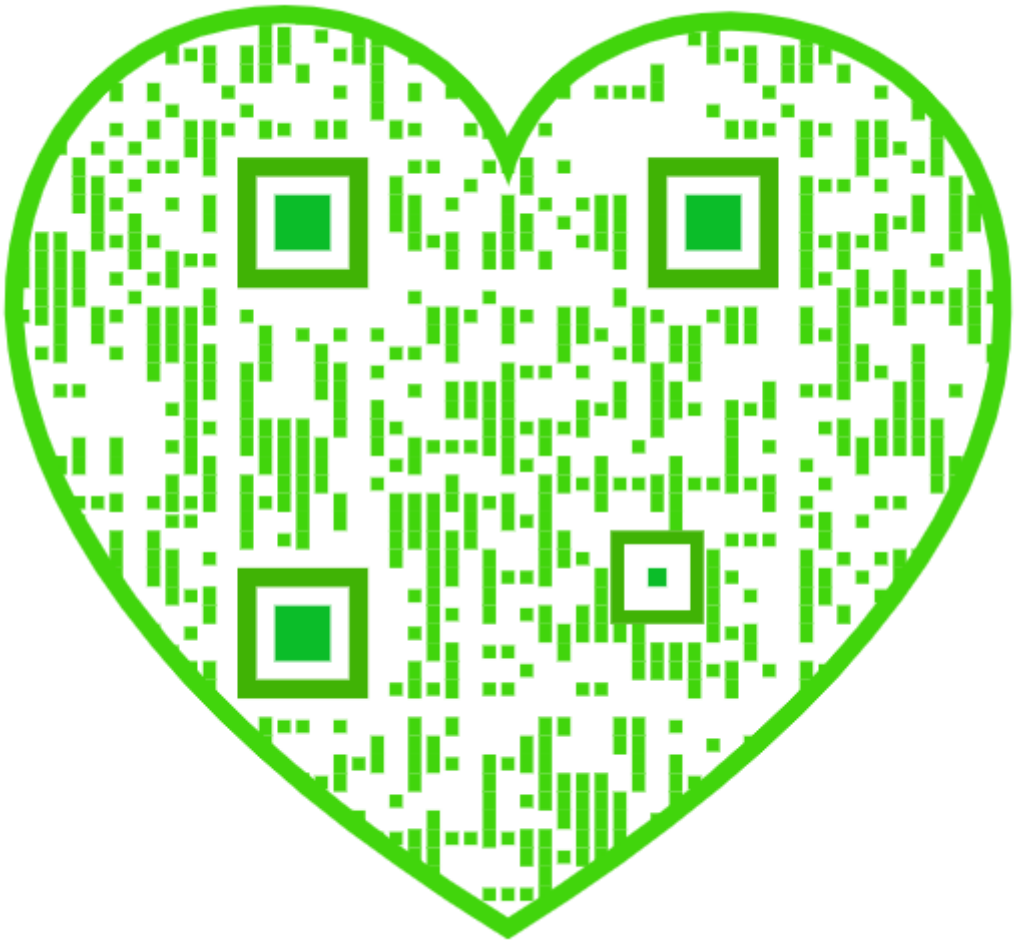


Displacement, 13,680 tons. **Speed,** 22.24 knots. **Coal Supply,** 2,000 tons. **Armor:** Waterline belt, 6 inches to 3 inches; Deck, 1½ inches on flat, 4 inches on slopes; Battery, 5 inches; Casemates, 6 inches; Turrets, 6½ inches. **Armament:** Four 8-inch; fourteen 6-inch; eighteen 3-inch; twelve 3-pounders; sixteen smaller guns. **Torpedo tubes:** 2 submerged. **Complement,** 822.

The Sister Ship "West Virginia," on Her Official Trial, November 2, Averaged 22.14 Knots.

NEW ARMORED CRUISER "COLORADO" IN DRYDOCK AT THE BROOKLYN NAVY YARD.—[See page 336.]



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NEW YORK, SATURDAY, NOVEMBER 12, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

FREE ALCOHOL FOR INDUSTRIAL PURPOSES.

There is an important measure before Congress, known as the Boutelle free alcohol bill, which should command universal support, once its purpose and scope are understood. The bill provides that alcohol for use in manufacturing and the industrial arts shall be free of tax, when suitably denaturized or made undrinkable by a mixture with noxious substances. The United States is the only leading commercial nation in the world that fails to make a distinction in the matter of taxation between distilled spirits intended for consumption, and alcohol intended for industrial purposes. All European nations permit the use of alcohol free of tax, when it has been denaturized in accordance with officially prescribed processes, and this for the reason that it is established as a sound principle of government that industrial alcohol should be made as cheap as possible. In Germany the laws upon this subject are particularly effective. As the matter now stands with us, industrial alcohol and alcohol for beverages are treated alike, being both classed as distilled spirits and subjected to a tax of $1.10 on the proof gallon of 50 per cent alcohol, which is the normal strength of alcoholic beverages. The strength of commercial alcohol is 94 per cent, and as this is 1.88 times the strength of the proof gallon, the tax on it is nearly $2.07 per gallon.

Now alcohol as a subject of manufacture may be purchased cheaply and with ease. The Department of Agriculture reports that 94 per cent alcohol, if it were not taxed, could be sold profitably for about 15 cents per gallon, and other authorities have asserted that, under the large demand that would result were the tax removed and under favorable conditions of manufacture, it could be sold at a profit for 10 cents per gallon. As matters now stand, however, manufacturers have been driven to adopt substitutes usually more expensive than untaxed alcohol, and frequently dangerous. Among such substitutes may be mentioned wood alcohol, naphtha, acetic acid, carbon bisulphide, gasoline, and many others. All of these substitutes are free from tax, and they are resorted to, not because they are better than grain alcohol, but because under the existing conditions they are cheaper.

The general public has but little idea how widely extended is the use of alcohol in all countries where it is not taxed. It is a better fuel for internal combustion engines and, therefore, for the automobile, than gasoline. It is preferable for domestic cooking and heating; and as an illuminant when used with an incandescent mantle, it is superior to kerosene and rivals the electric light. Alcohol is necessary in the manufacture of a thousand different articles, and it is a serious item of expense in making varnishes, lacquers, gilding, and bronzing. It is used as a solvent in the manufacture of hats, straw goods and fine shoes. One and a quarter pounds of alcohol are consumed in making one pound of the best smokeless powder, and it is claimed that the present tax more than doubles the cost of this important commodity to the government. It enters also largely into the manufacture of celluloid, with its many dependent industries; hence, it affects the interest of the photographer. It is one of the most important of the costly raw materials in the manufacture of various colors for silk, cotton, and woolen goods, wall paper and printer's inks, and in dyeing it is a valuable agent in fixing the colors. Indeed, the majority of the manufacturers in this country make use of alcohol or some derivative therefrom, to a greater or less extent in the production of their goods. There are some industries that have been driven out of the country altogether by the present tax, a case in point being fulminate of mercury, the explosive material of percussion caps, which is now imported from Canada at a cost from one dollar to one dollar and fifty cents per pound cheaper than it can be made here.

The benefits resulting from the repeal of the alcohol tax would be felt immediately by both the maker and user of the automobile. At present gasoline is practically the only motor fuel available, and there is no doubt the development of the automobile is handicapped somewhat by the present price of this fuel, to say nothing of the apprehension that it will steadily increase in price with the development of the automobile industry. Alcohol has been tested very extensively abroad, and it is considered in France to be in every way a superior fuel to gasoline, being free from all obnoxious qualities, and far less dangerous to the user.

It is claimed by the sponsors of this bill, and we think with every show of probability, that the removal of the tax and the cheapening of this easily-made and extremely useful commodity would, in addition to its indirect benefits to the many industries affected, so stimulate its manufacture as to result in the development of an entirely new industry that would afford a promising field for the investment of capital and for the employment on a large and increasing scale of labor. It is also claimed, and we think on good economic grounds, that the reduction of government revenues due to the repeal of the tax would be more than compensated by the increased demand for other articles that are the subjects of taxation, whose cost would be considerably reduced were grain alcohol exempted.

INDIAN SUMMER.

No period of the year excels in loveliness the one sometimes known as "the fifth season." Beginning about the middle of October, it is often prolonged into December. Its characteristics are a calm, soft, hazy atmosphere, through which day after day the sun, shorn of his beams, rises and sets like a sphere of copper or gold, according to each beholder's degree of poetic perception. Sounds at great distances are distinctly audible. Objects, unless close by, are discerned with difficulty. All nature, as if to prepare itself against the blasts of winter, appears somnolent. The mornings are cool, with lowland fogs soon dissipated by the sun, and the atmosphere maintains a stillness which scarcely stirs the richly-tinted but rapidly-fading foliage.

The northern hemisphere enjoys the finest displays of this supplementary season, the geographic limits of which the records of meteorologists and climatologists enable us to define. Its characteristics are particularly noticeable in the far Northwest. Matthew Macfie, F. R. G. S., is authority for the statement that in Vancouver Island and other portions of British America there is a second growth of verdure lasting until after Christmas. This period annually beautifies the zone running through New England and Canada westward to Lakes Michigan and Superior, thence southwestward to Kansas and Nebraska, and, including Minnesota, the Dakotas, Montana, Idaho, Wyoming, Washington, Oregon, and Northern California, northwestward over British America to the Arctic Circle. While it does not extend into the lower limits of the United States, it is referred to by two or three of the historians of Mexico.

Formerly the smokiness, and the somewhat greater degree of warmth, were thought to be caused by mountain fires, or the burning of the vegetable decidua collected in the autumn for that purpose. The haze and increased warmth are due to the annual formation of what has been termed the "aerial Gulf Stream," or "vapor plane." This high current, generated in equatorial seas by ascending masses of vapor-charged air, flows northward through the upper atmosphere, oversweeps the Southern and Gulf States, and descends toward the earth or ocean as it approaches New England and Canada on its journey toward the polar circle. In the afternoon and night, when the earth throws off the heat received during the day, especially in the autumn weeks, when the temperature is declining and the capacity of the air to retain moisture is on the decrease, the presence of this mantle of vapor arrests radiation. The heat-absorbing power of this "blanket of aqueous vapor" has been clearly demonstrated by Prof. Tyndall. Covering the remaining vegetation and the harvests as with a shield, it protracts the grain-ripening period to meet the necessities of the higher latitudes.

The earliest explorers of America recorded their appreciation of the beauties of this season, but did not assign to it a specific name. Our pioneer historians, notably Jefferson, note its features as among the most fascinating exhibited by our climate, but do not designate it as "Indian summer," a name which now belongs to it by the common consent of the people of the United States, Canada, Australia, and a portion of Europe.

The first recorded appearance of the name "Indian summer" is found under date of October 13, 1794, in the journal of Major Ebenezer Denny, an army officer stationed at Fort Le Bœuf, near the site of the present city of Erie, Pa. The term seems to have been already well known and clearly recognized. The New England tradition is that the term "Indian summer" is derived from the prevalence, at that time, of the southwest winds, which the Indians supposed to be sent as a peculiar favor from their good deity, Coutanowoit, to whom, says the Rev. James Freeman, they believed they would go when they died.

A more logical reason is that, in many portions of the United States, it was the Indian's hunting season, not only on account of the plenty and perfect condition of the game, but because of the density of the atmosphere, which favored a close and unsuspected approach to the creature pursued. Among the Indians of the Northwest, it was the period between the gathering and storing of summer supplies and the selection of winter quarters in the haunts of large game. Hence, Indian summer in that region was the season of migration, its mildness being favorable for journeys. On being asked when they intended to go to their hunting-grounds, their usual reply was: "When the Great Spirit sends us our fall summer." Persons whose imaginations are sufficiently vivid may find in the appearance of the November sun a resemblance to the Indian complexion.

According to the exhaustive researches of Mr. Albert Matthews, the term "Indian summer" first made its appearance in the last decade of the eighteenth century; was "established about twenty years after its earliest appearance; had spread to New England about 1798, to New York by 1809, to Canada by 1821, and to New England by 1830." Mr. Matthews states that it "is not merely an Americanism, but has become part of the English language in its widest sense, having actually supplanted in England expressions which had there been in vogue for centuries, and is now heard among English-speaking people throughout the world; that it has been adopted by the poets; that it has been employed in a beautiful figurative sense, as applied to the declining years of a man's life; and that it has given rise to much picturesque if also to some fantastic writing."

This season is well defined in England. It is peculiar also to central Europe. In the old world as in the new it is characterized by dry fogs, a glowing sky, absence of heavy rain, and mild temperature. In different localities it is known by the names of various saints and religious festivals, all of which are celebrated in the autumn months of the calendar. In England its early name was "All Hallows' summer." In Wales and Belgium it is known as "St. Michael's summer," in Germany as "St. Gall's summer" and the "summer of old women," in Bohemia as "St. Wences-laus' summer," in Sweden as "St. Bridget's summer," and in Lombardy as "St. Theresa's summer."

In Belgium, most gorgeous are the Indian summer displays in the vicinities of St. Hubert and in the celebrated old forest of Ardennes, which localities, at this season, doubtless taught Van Dyck, Rubens, and other Flemish painters their brilliancy of color. Among other European names for this period are "the after-heat" and "the red leaf."

In some portions of France it is named in honor of St. Denis, but is chiefly known as "St. Martin's summer," to keep in pious memory the bishop-saint who died at Tours in 397, having successfully brought to Christianity every person in his diocese. He changed an autumn festival in honor of Bacchus to a Christian celebration; and centuries after it became his own day in the calendar (November 11), it was still burdened with heathen usages. To this day St. Martin is the patron of drunkards who are endeavoring to reform. Not only is "St. Martin's summer" the most charming period of the year in France, but it is identified with the good cheer and hilarity of the vintage, as well as with the abundance of the harvest and the chase.

This season's influence extends over Prussia, Austria, and Hungary. Its close marks also the passing of the deadly miasma from the Pontine marshes. The beauty of Lakes Como, Maggiore, and Garda is never seen to better advantage than during this golden period. Covering the vintage time of Greece, it insensibly merges into the days which, immediately preceding and succeeding the winter solstice, were known to the Hellenes as the "halcyon days," because at that period the halcyon brooded. Their winter seas were then free from storms.

In Indian summer and all its cognates Nature discloses a brighter purpose than mere scenic display. In it may be recognized the gigantic and ever-active atmospheric forces, which not only temper the regions from which the sun makes an early autumnal retreat, but ordain fertility, verdure, and health over vast territories of the earth.

Steatite or soapstone, $Mg_3H_2Si_4O_{12}$, gives very good fibers when fused to a clear bead in an illuminating gas-oxygen blowpipe flame working small and steady, and then drawn. The fibers become brittle if afterward heated in a Bunsen flame. The fibers show all the characteristic properties of fused quartz, and the material is readily obtained from an old gas-burner (steatite hardened by heat).

TURPENTINE DERIVATIVES.

BY DR. L. REUTER.

Referring to the interesting paper on "Pine Products," written by Mr. Th. W. Pritchard for the SCIENTIFIC AMERICAN SUPPLEMENT, I would like to say that there are several important products made in Germany from American spirits of turpentine which are not as yet manufactured in the United States; these products are terpin hydrate and terpineol.

The first named article, the terpin hydrate, has attained such an importance as a valuable remedy, that it has even found a place in the U. S. Pharmacopœia, where its properties are fully described and methods given for the examination of its purity.

Although prepared from turpentine, terpin hydrate is, when chemically pure, an absolutely odorless substance and crystallizes in beautiful colorless prisms. It is used as expectorant, antiseptic, diuretic and diaphoretic in bronchial affections, whooping cough, throat affections, tuberculosis, and many other diseases, and it is employed so extensively, that about 35,000 pounds of it are imported from Germany, where it is manufactured in chemical factories exclusively from American spirits of turpentine. Being a chemical compound under the regulations of the Tariff Act of July 24, 1897, it has to pay a duty of 25 per cent *ad valorem* on entering this country.

The second turpentine derivative not yet manufactured here is terpineol or synthetical lilac; it is an oily liquid and possesses a very agreeable odor which is almost identical with that of lilac flowers; it is used as a base for quite a number of perfume compositions, and a solution of it in alcohol mixed with some heliotropine, etc., is considered to be one of the best lotions which we have for scalp and face.

About 45,000 pounds of terpineol are annually imported from Germany; like terpin hydrate it pays a duty of 25 per cent *ad valorem*.

Before entering into the details of the manufacture of these two articles, I wish to state that the proper locality where the same could be cheapest and best manufactured, is the southern part of this country, especially the pine-regions, where spirits of turpentine is made on a large scale either from turpentine or by distillation of pine wood. In these districts the manufacture of the above mentioned and of other even more important turpentine-derivatives like synthetical eucalyptol, synthetical borneol, the latter being manufactured to a very great extent at Leipsic for consumption in the Far East, synthetical camphor, etc., should be developed, and it would be an easy task to supply the world from here with articles of as good a quality and as cheaply or cheaper than German factories.

American manufacturers would have a further advantage in so far as they could use certain discolored grades of turpentine or grades obtained from pine wood by destructive distillation and containing traces of creosote, etc. That such cheaper grades can be used for manufacturing purposes, that the yields and the quality of the final products are perfectly satisfactory, and that the products are identical with those made from the purest spirits, I can confirm from my long practical experience in that special line of manufacturing.

Two methods are used in these days for the manufacture of terpin hydrate—the first of which consists in exposing to the air in flat dishes a mixture of spirits of turpentine, nitric acid, and alcohol, separating the crystals which are formed after some time and purifying the same by recrystallization. This method can be used profitably, especially in such countries where the price of alcohol for industrial purposes amounts to less than one-tenth of that to be paid in this country.

I used this method successfully for a number of years and while experimenting with the mother-liquors, left after the separation of the terpin hydrate crystals, I made a very interesting discovery, which will, if technically fully developed, open new and important opportunities for the development of industry and commerce in the South.

While experimenting, as stated, with the mother-liquors of the terpin hydrate manufacture for the purpose of finding a better outlet for that by-product than that for which it has been used, namely for varnishes, etc., I discovered that it contained up to 5 per cent and sometimes even as much as 9 per cent of eucalyptol, which is the most valuable constituent of the oil of certain eucalyptus species, especially of *Eucalyptus globulus*, Labillardière, the Australian blue-gum tree. Thanks to the indefatigable labors of Hon. Abbot Kinney, Hon. Ellwood Cooper, Mr. A. Campbell-Johnston and others, that tree is now extensively cultivated in Southern California. Many tons of eucalyptus oil are consumed in this country, 90 per cent of which is imported from Australia by way of England; and also very large quantities of eucalyptol, extracted by special methods from eucalyptus oil in German chemical factories, are imported in the United States, paying a duty of 25 per cent *ad valorem*, $1.00 to $1.20 being realized per pound for that quality which answers the requirements of the U. S. Pharmacopœia.

As the eucalyptol which I obtained as by-product in the manufacture of terpin hydrate is chemically and physiologically identical with the natural eucalyptol, it is only a question of time when it will ultimately be made from spirits of turpentine exclusively, and as any cheaper grade of spirits can be used for making eucalyptol, the most favorable locality for its manufacture will naturally be the pine districts of the South.

When the process of making eucalyptol from turpentine will be fully developed in this country, it will become necessary to protect that new industry by a prohibitive duty of at least 50 cents for each pound of eucalyptol and also 50 cents for each pound of eucalyptus oil "containing 20 per cent and more eucalyptol." It would not do to impose only a duty on eucalyptol, as it is very probable that if only the duty on that article is raised, it will be invoiced and imported as oil of eucalyptus. While a duty of 50 cents on each pound of eucalyptus oil containing 20 per cent or more of eucalyptol would protect the manufacture of synthetical eucalyptol, the duty on ordinary eucalyptus oil, which contains principally phellandrene and only a very small quantity of eucalyptol, could remain as fixed by paragraph 3 of the Tariff Act of July 24, 1897, namely 25 per cent *ad valorem*. Of course, it is to be expected then that the Treasury Department will have all the imported eucalyptus oil examined chemically as to the percentage of eucalyptol it contains.

And now a few words in regard to the manufacture of synthetical camphor from spirits of turpentine. In the SCIENTIFIC AMERICAN of November 21, 1903, an interesting paper was published concerning the manufacture of this article at Port Chester; unfortunately the manufacture has recently been abandoned, probably because of the great expense of materials. The proper locality to manufacture this article would have been the South, for the following reasons: The two principal raw materials entering in the manufacture of synthetical camphor are spirits of turpentine and oxalic acid; in regard to the first item, the spirits, I have to say, the cheaper grades of that article, viz., such as are obtained in the destructive distillation of pine wood and containing traces of creosote, will do for making camphor, and such grades could have been purchased in the South for less than half the price which had to be paid for the pure market article. Also expenses for shipping of raw materials, for barrels, etc., would have been reduced to a minimum if that industry had been started in the turpentine districts. As a matter of fact, every young industry needs conscientious and conservative development, and the nearer the factory is located to the source of the raw materials the more independent will it become and the more profitable will it prove to be in the end.

The second raw material for the making of camphor is oxalic acid. Though some of that article is manufactured in this country, there is still a considerable quantity imported. In 1903, 5,363,646 pounds, valued at $257,289, were imported. Oxalic acid is on the free list of the tariff of 1897 and that is the reason why its manufacture has not been developed. If the fact is considered, that the principal raw material for making oxalic acid is sawdust, which goes to waste or is obtainable nowhere cheaper than in the lumber districts of this country, it is evident that oxalic acid can be made here as cheap or cheaper than anywhere else.

In my opinion both industries, the manufacture of oxalic acid and of synthetical camphor, should be taken up jointly in the South by one and the same company. Oxalic acid at manufacturing cost price would naturally be a good deal cheaper than the article purchased from other manufacturers or from importers, and, at the same time, all oxalic mother-liquors could more easily and more cheaply be re-converted into oxalic acid.

But why not go a step further? Why not protect such important industries by prohibitive duties, especially if such industries can stand exclusively on domestic raw materials? If on crude camphor, which enters duty free, a duty of 50 cents per pound is imposed (imports, 1902, 1,831,058 pounds, $576,405; 1903, 2,508,420 pounds, $764,403); on refined camphor instead of the present duty rate of only 6 cents per pound also a duty of 50 cents per pound and on oxalic acid a duty of 10 cents per pound, there can certainly be no doubt that the above-mentioned industries depending solely on American materials would flourish and become very profitable enterprises. The country at large would learn to become independent from imported crude materials and would stand on its vast resources; and last, but not least, the Southern States would be brought on a better footing with the manufacturing States and on a higher level generally.

Several patents for the manufacture of synthetical camphor from spirits of turpentine have been granted here and in Germany. A number of chemists are actively engaged in the scientific laboratories of large factories in Germany to develop the technical process of making camphor. It is not to be doubted that the synthesis of camphor will be realized in the near future and that some day we shall read in the newspapers that Germany does not need natural camphor from the Far East any longer, that she succeeded in standing on her own resources in regard to camphor as she succeeded so gloriously in making herself independent from natural indigo by carrying out on the grandest scale the manufacture of synthetical indigo from coal tar.

It is to be hoped that when this time arrives the problem of manufacturing synthetical camphor will also have been solved in this country. Likewise, that our far-sighted philanthropists, who so liberally provide enormous annual sums for medical, electrical, and general engineering sciences, will have recognized the necessity of providing means for original synthetical research-work, a science of greatest practical importance, which thus far has been utterly neglected in this country, and which will prove not only a blessing to organic-synthetic chemistry, but through it, to humanity at large.

SCIENCE NOTES.

A discovery of considerable importance was made in August last at Suse, the ancient Segusio, in the province of Turin. Some excavations were being made near the Arch of Augustus at a place which has already yielded some objects of great value. At a depth of six feet or more a colossal man's head was found. It is of bronze and is double the natural size. The head is of excellent workmanship, and is well preserved. It is supposed that the head belonged to a statue of the minister of Augustus, Marcus Vipsanius Agrippa, who was the husband of Julia, daughter of Augustus. Agrippa was the grandfather of Caligula and the great-grandfather of Nero. He died in the year 12 B. C. The excavations are being continued, in the hope of further finds.

M. Gauckler has recently given an account of the results which have been obtained by the exploring expedition in the region of North Africa which was formerly known as the *limes Tripolitanus*. The explorations are being carried on by the Tunisian Society of Antiquities and Arts, of which this eminent savant is the head. The society is aided by the officials of that country. Among others is the recent discovery of Lieut. Pericaud. At 10 miles from the post of Matmata, in the most remote part of the mountainous mass of the same name, he discovered a fortified Roman farm, which is the most important of the remains hitherto found in this region. The Roman civilization, of which this is a trace, was established in the south of Tunisia in the second and third centuries A. D., following the military occupation of the country.

From his previous experiments on the action of N-rays Charpentier has been led to inquire whether there is a specific reinforcement when there is placed near a sensorial organ or the corresponding nervous centers the physical excitant capable of acting upon them. He finds, for instance, that when a phosphorescent screen is made having for base an odoriferous substance, the luminosity of this screen is increased opposite the nervous centers, especially near certain of them which may be called olfactory points. Similar effects occur in the case of the organs of vision and the related nervous centers when a screen with a luminous base is used. It is inferred from the experiments: (1) that the sensorial nervous centers are specifically different; (2) that there is a certain adaptation not only between physical agents and the sensorial agents destined to receive them, but between these agents and the nervous centers which perceive them after reception by the sensorial agent; (3) that there are certain common properties implying analogy of nature between sensorial excitants and the peripheral or central nervous organs destined for their perception, since they show by the sort of specific resonance referred to, analogous emissive properties.

In a recent issue of the Archives des Sciences Physiques et Naturelles, Messrs. Jacquerod and Perrot record their investigation on the melting point of gold and the expansion of some gases between 0 deg. and 1,000 deg. C. The thermometer used was a gas thermometer, in which the glass bulb was replaced by a bulb of silica soldered to a capillary tube connected with the manometer and likewise made of silica, this being a very refractory material, whose expansion is about twenty times less than that of platinum. A piece of gold wire, placed beside the bulb in an electrically-heated furnace, closed an alternating electric circuit including a telephone; the latter would cease vibrating at the moment of melting. According to these experiments, the melting point of gold on the nitrogen thermometer scale (with constant volume) would be in the neighborhood of 1,067 deg. C. On the other hand, it is shown that the average coefficients of expansion of nitrogen, oxygen, air, and carbon monoxide, between 0 deg. and 1,000 deg. C. may be taken as identical, whereas the coefficient of carbonic acid is somewhat less than its value between 0 deg. and 100 deg. C. These experiments are to be repeated with helium thermometers.

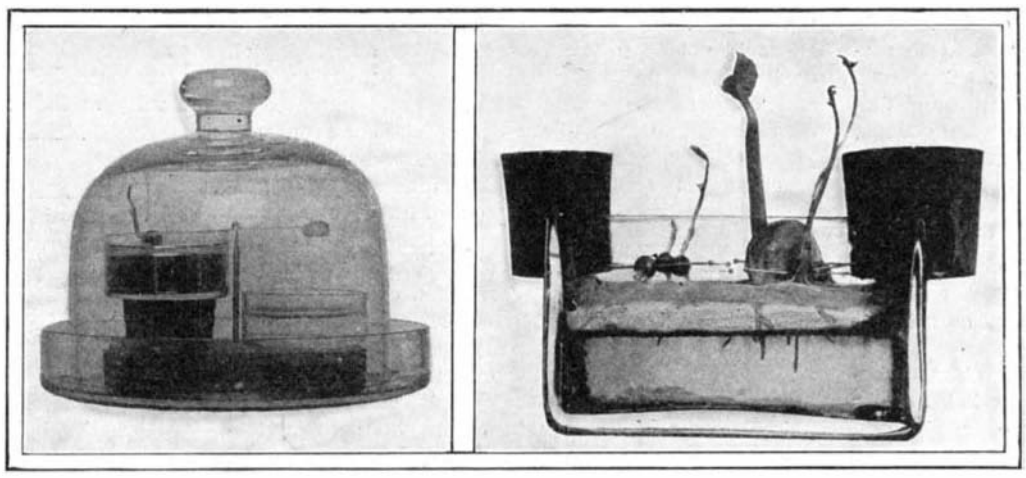
PENETRATION OF MERCURY BY SEED RADICELS.

BY EMILE GUARINI.

Herr Ph. van Harreveld has recently made some curious experiments upon the interesting subject of the penetration of mercury by the radicels of germinating seeds floating upon the metal. The phenomenon has given rise to much controversy and is singularly paradoxical when we take into consideration the great density of mercury as compared with that of a seed. The first mention of this curious prenomenon dates back to 1829, when M. T. Pinot presented to the Academy of Sciences of Paris a memoir upon the subject under consideration. He had caused the germination of seeds floating freely upon mercury, and had seen their radicels penetrate the latter to a greater depth than was compatible with the laws of hydrostatics. Although the weight of the seeds was less than the pressure of the mercury in a contrary direction, the radicels nevertheless penetrated the metal. In order to explain the phenomenon, it was necessary, as was then thought, to have recourse to a particular vital force. Dutrochet repeated the experiment during the same year, but was unsuccessful. Nevertheless, C. Mulder, in 1829, H. R. Goeppert, in 1831, and Poyer, in 1844, confirmed the accuracy of Pinot's observations. In 1845, Durant claimed that the radicels would not penetrate unless the seeds were fixed by a coating composed of mercury and organic substances of the seed soluble in water. In 1854, the phenomenon observed by Pinot was confirmed anew by A. Wigand, but denied in 1860 by Hofmeister and again in 1865 by the celebrated botanist Sachs.

The matter has now been definitely settled by the experiments of Herr van Harreveld, in whose opinion the seed is fixed by the molecular pressure of the water which ascends through capillarity around it. In fact it is necessary always to put a little water upon the mercury in order to keep up the germination of the seeds. The extent of the upward pressure of the mercury and the downward molecular pressure of the water can be calculated approximately. The latter is greater than the difference between the weight of the seed and the pressure of the mercury. Moreover, Herr van Harreveld repeated the experiment of Pinot with a very sensitive scale beam. He balanced the weight of the seed by a small piece of paraffine, both the former and the latter being placed at the ends of the beam. In this case, the molecular pressure alone must have surmounted the upward pressure, since the radicels of the seed employed (that of *Lathyrus odoratus*) penetrated to a depth of nearly three-tenths of an inch. It is possible even to add a weight of a grain and a half to the paraffine before the radicels are made to emerge from the mercury.

According to Herr van Harreveld, MM. Dutrochet, Durand, Hofmeister, and Sachs too lightly refuted the observations of Pinot and Wigand, and MM. Mulder, Goeppert, and Poyer did not really effect a penetration such as was witnessed by Pinot, since they fixed the seeds too slightly. Poyer determined the depth to which the radicels penetrate by putting a stratum of mercury above one of water. The two strata were separated by a platinum grille covered with a piece of tulle. Herr van Harreveld repeated this experiment with a grille of japanned iron and found that the radicels traversed the mercury and penetrated the water.



A NOVEL EXPERIMENT SHOWING THE PENETRATION OF MERCURY BY SEED RADICELS.

ERECTING THE COLUMNS FOR THE CHOIR OF THE CATHEDRAL OF ST. JOHN THE DIVINE.

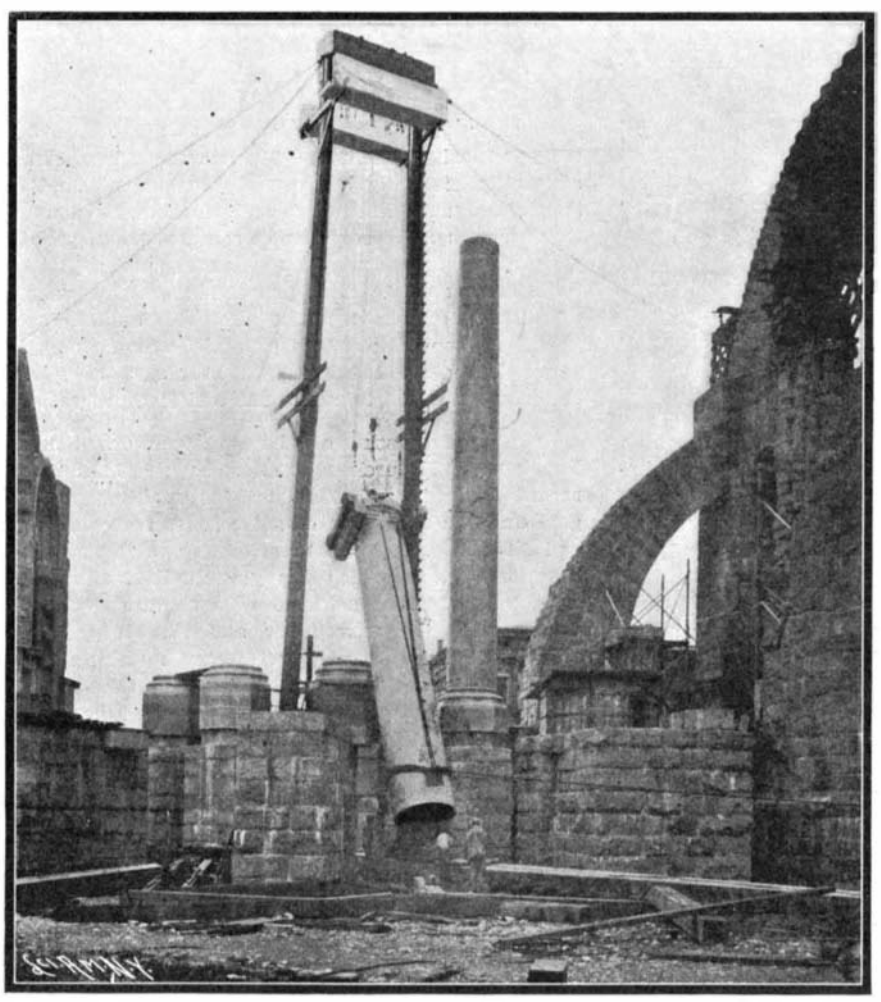
On the third of October of last year the SCIENTIFIC AMERICAN published a brief description of the manner in which the huge sections of the columns for the choir of the Cathedral of St. John the Divine, Morningside Heights, New York city, were transported from the wharf, where they were landed from a lighter, to the scene of operations. These huge columns were originally intended to be monolithic, and it will be remembered that several enormous lathes were specially built to turn them. However, this could not be successfully accomplished, as the 55-foot columns broke during the polishing operation, one when it was within a few hours of completion. They were therefore made in two sections, one 37 feet 6 inches long and weighing 90 tons, and the other 17 feet long, weighing between 40 and 45 tons. At the present five of the columns have been erected and the remaining three will be in position within a few months. The photographs illustrate the method employed in doing this.

The larger section, as it comes from the Vinalhaven, Me., quarries, is somewhat longer than necessary, and its upper end is roughly shaped into a cap with a flange about a foot thick which projects some three inches beyond the surface of the column proper. To raise this section and place it upon the base intended for it, a huge clamp made of great timbers bolted together is placed around the stone just below the flange left for that purpose and is drawn tight by means of long, heavy bolts. The lower pulleys employed are hooked into shackles bolted to the timbers. The first illustration clearly shows this wooden clamp and the long iron bolts used to tighten it around the column. By means of a steam drill two holes are made in the lower end of the stone into which two iron pins, some 4 or 5 inches in diameter, fit loosely. These pins rest on a shoe built of heavy timbers which is moved along on rollers as that end of the column advances with the gradual rise of the upper end. When the lower end also is about to leave the ground the pins drop out, a retaining cable preventing the stone from swinging against the base or other stonework. When the larger section is fixed in place, stone-masons cut away the rough cap, leaving that part of the column of the right length and ready for the superposition of the smaller section. This is raised in a similar manner, but instead of using the wooden clamp—the stone being already cut to its proper length—a lewis is employed, and only one pin is inserted in the lower end. The hoisting is done by a powerful winch drawing steam from a stationary donkey boiler and the boiler of a 40-horse-power traction engine.

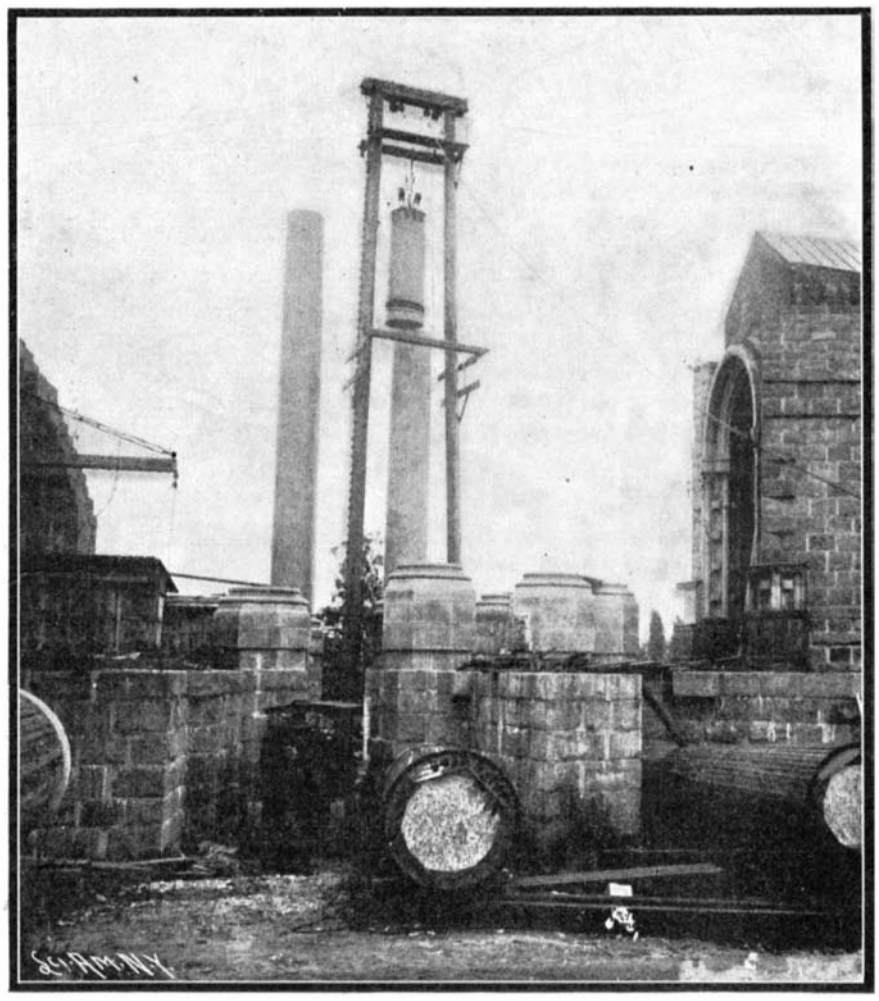
The derrick itself consists mainly of two 96-foot timber uprights tapering from 20 to 24 inches in diameter. While hoisting one of these huge stones these timbers seem perilously light, but as a matter of fact they will with safety bear nearly double this load. When the derrick is to be moved from one position to another two powerful jacks lift it slightly from the ground, the flooring surrounding the column base—of 10 x 10 timbers—is soaped, and the derrick is easily moved, little by little, the guy ropes being slackened or tightened as necessary.

International Automobile Show in Berlin.

An international automobile show is to be held at Berlin, under the patronage of the German Automobile Club, in connection with the Chamber of Automobile Industry. It will last from the 4th to the 19th of February next. Prince Henry of Prussia is to have the nominal patronage of the affair, and the organization committee is formed of the Duke of Ratibor, Baron von Brandenstein, Gen. Becker, and others of equal prominence.



Raising the Lower Section of the Column. The End About to Leave the Shoe.



Lowering the Upper and Smaller Section Upon the Lower One.

ERECTING THE HUGE COLUMNS FOR THE CHOIR OF THE CATHEDRAL OF ST. JOHN THE DIVINE.

A RECORD IN ORE UNLOADING.

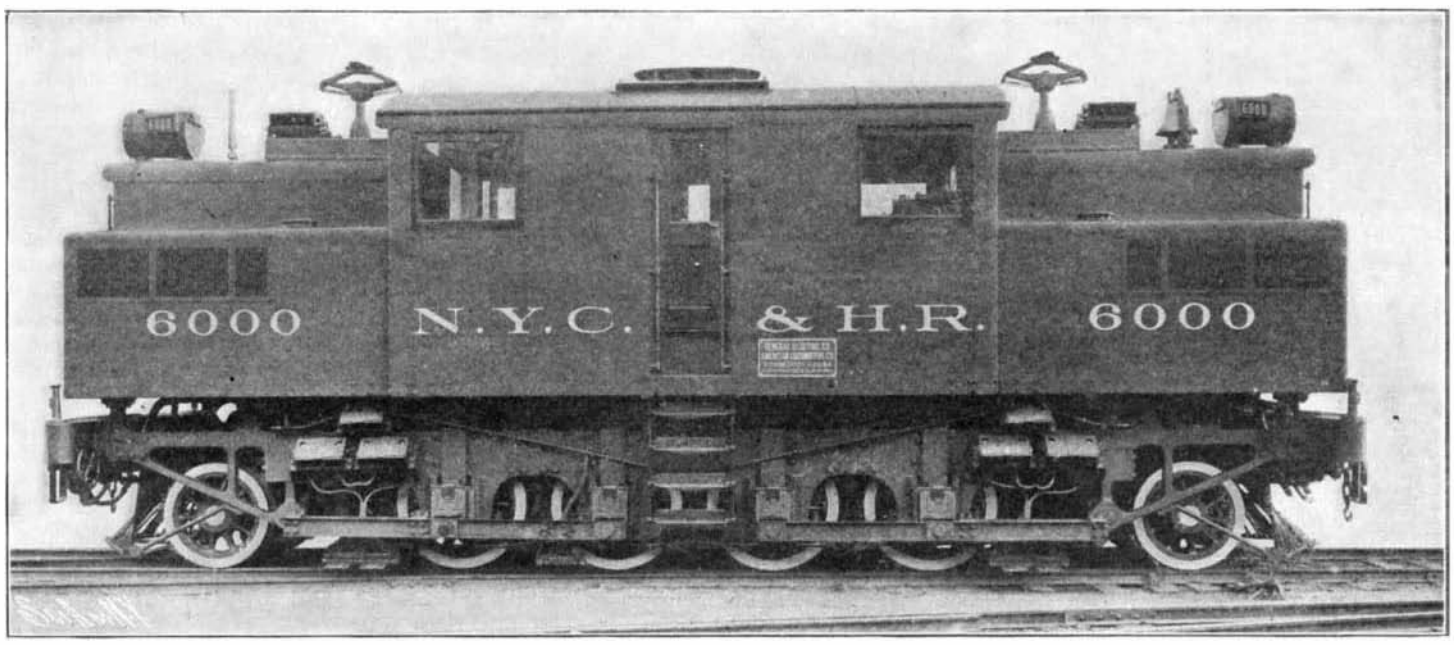
BY W. FRANK M'CLURE.

A new world's record for the rapid handling of iron ore has been established during the present season of navigation upon the Great Lakes. In the making of the new record the former one was cut straight in two, an accomplishment of no little moment in the industrial world. By the working of two kinds of modern ore machines at one time in the new steamer "A. B. Wolvin," nearly 10,000 tons were removed in four hours and a half.

Soon after the launching of the new steamer "Wolvin" last spring, an article appeared in the SCIENTIFIC AMERICAN descriptive of the distinctive features of that ship which were expected to work something of a revolution in ore handling. Chief among these was mentioned the hopper bottom, which admitted of keeping the ore at all times within reach of the automatic clam-shell buckets; also that the length of this hopper, without division, is 409 feet. This construction has come up to all expectations in facilitating the work of loading and unloading.

The new record was made at Conneaut harbor, the port which has in recent years been noted for its wonderful machinery and its notable records. The work of unloading was started at 7.22 in the morning and was completed at exactly 11.52. The total delay in the continuous operating of the machines did not exceed five minutes. Eight machines were used in all, four of the Brown machines, which are fitted with clam-shell buckets, and four of the Hulett machines, which are the automatic ore unloaders with the ten-ton buckets. The accompanying protograph shows both kinds of machines at work in the "Wolvin's" hold, those at the forward end of the vessel being the Browns. In all the vessel has thirty-three hatches. As soon as one machine finished a hatch it was transferred to another without a moment's delay. Officials of both the dock and the machine companies were on hand to witness the test and to assist in avoiding the slightest impediment. The exact amount of ore removed was 9,945 tons. The Hulett machines removed 169 carloads of the total of 226 which the boat contained.

The former record was held by South Chicago, where a similar cargo was removed from the "Wolvin" soon after it entered the ore trade. Ten and a half hours were required for the unloading operations at that time. The vessel was under the machines for fifteen hours, of which four and a half hours were lost. Fifteen machines were used.



NINETY-FIVE-TON ELECTRIC LOCOMOTIVE FOR NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

Of interest in connection with the records of the "Wolvin" is the announcement which has been made this fall that four vessels still larger than the "Wolvin" are to be built for the Pittsburg Steamship Company, which is the lake end of the United States Steel Corporation. These vessels are to be 569 feet over all, 540 feet keel, 56 feet beam, and 31 feet deep. Their construction will be of the arch system, resembling that of the "Wolvin" and "Sahara." There will be thirty-four hatches and no bulkheads in the hold. The four vessels will cost more than $1,500,000 and are to be completed by the first of next July.

ELECTRIC RAILWAY LOCOMOTIVES FOR THE NEW YORK CENTRAL.

The broad field for the electric locomotive is undoubtedly to be found in the partial or complete electrification of existing steam railroad systems, and the delay in the development of this department of electric transportation must be ascribed to the radical and extensive changes in equipment and operation, the magnitude of the necessary investment in the equipment of trunk lines, and the general lack of appreciation of the merits and economies to be obtained.

There are, however, certain classes of service in connection with steam railroads, electric railways, and industrial transportation systems in which the advantages of the electric locomotive and the economies to be obtained by its adoption are at once apparent. The appreciation of these advantages has already resulted in several successful installations of electric locomotives, both on steam railroads and in other classes of service, which are proving the adaptability and economy of the electric locomotive.

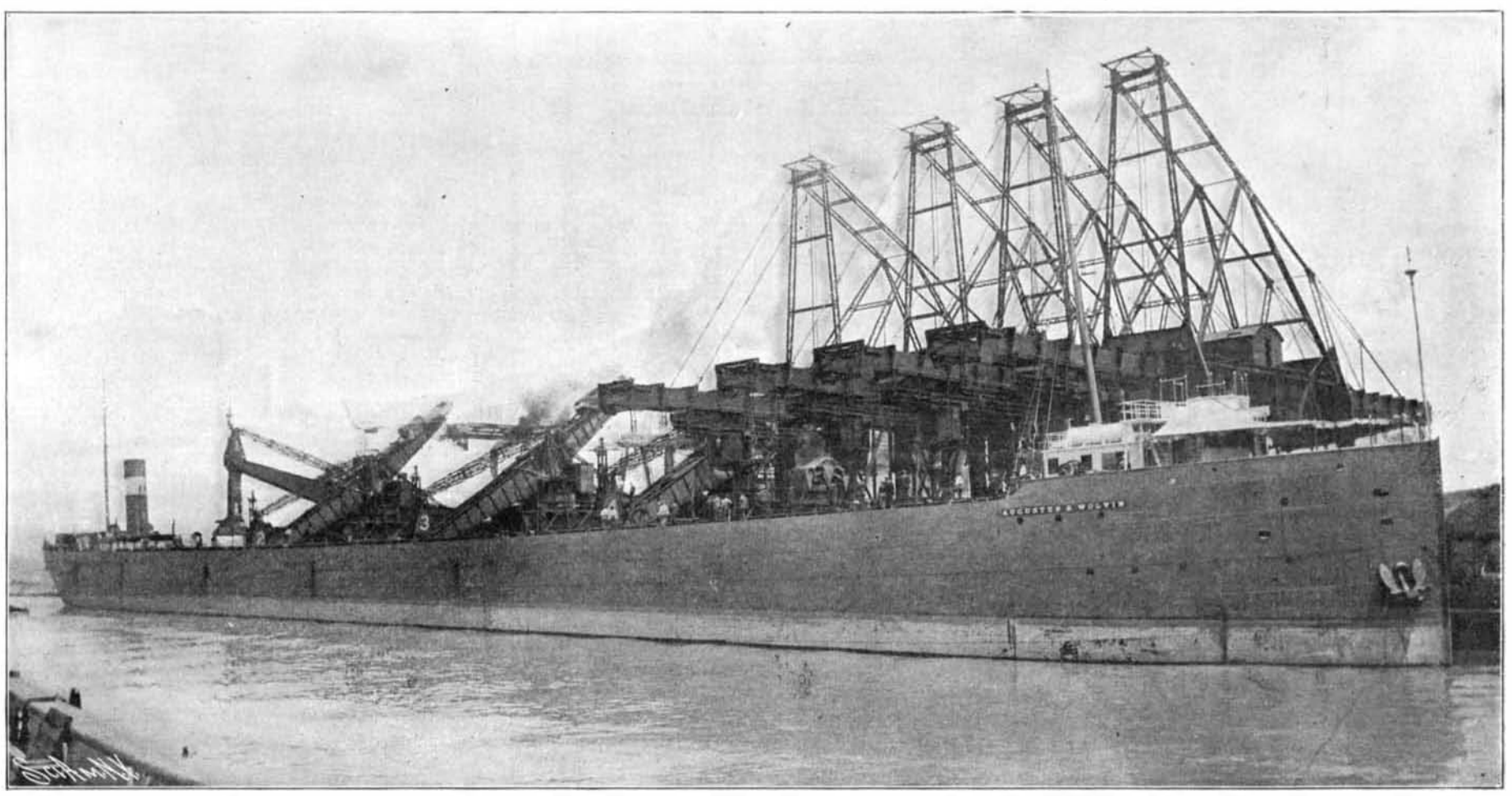
In the absence of noise and smoke the electric locomotive has an advantage that has long been recognized. This feature alone has caused its adoption in certain cases, such as switching around buildings, in city streets or in tunnels. The New York Central and the Baltimore & Ohio locomotives are prominent examples in which this feature would have forced the adoption of the electric locomotive, even if no consideration of economy of operation had been present.

The electric locomotive lends itself to a greater variety of service than the steam locomotive, and has a greater range of capacity. In the steam locomotive the generating station or source of power, the boiler and the fire box, are seriously limited by considerations of space between the drivers and height of center of gravity above rail head, considerations which do not apply to the electric locomotive.

An electric locomotive can be built in several units, or sections. The 160-ton B. & O. locomotive described in these columns some time ago is a characteristic example of this type of construction. One section can be used for a light train, or the several sections coupled together can be operated by a single crew for trains of greater weight. Any such double heading with steam locomotives can be accomplished only by two independent units with separate crews.

The electric locomotive is able to use the power it exerts to better advantage, due to the uniform torque on its drivers, and the perfect control of its speed.

The application of electric traction to trunk line service has not yet been developed to any extent on account of the relative infrequency of service and the enormous expense of sub-stations and distributing systems for operation at the usual potential of 500 or 600 volts. The single-phase alternating current motor, which the General Electric Company has recently de-



THE FOUR HULETT CLAM-SHELLS AND THE FOUR ELECTRICAL BROWN CONVEYERS AT WORK UNLOADING THE ORE-CARRYING STEAMER "AUGUSTUS B. WOLVIN" IN RECORD-BREAKING TIME.

veloped, makes it possible seriously to consider the installation of electric locomotives for trunk line service. With this alternating current motor it is possible to deliver current to moving units at a pressure of 2,000 to 3,000 volts on the trolley, with the effect of reducing the amount of current to be handled by the moving collectors and of increasing the radius of distribution without a prohibitive cost of distributing conductors.

The final possibilities of this type of motor are as yet unknown, but in the electrification of trunk lines, particularly in regions where coal is expensive or water power available, is to be found the field for which the alternating current, single-phase railway motor is peculiarly suited.

The New York Central locomotives may be regarded as a noteworthy advance in the adaptation of the electric locomotives to the needs of high-speed trunk line service. They differ from most of those that are at present in use throughout the world in that they are to be used for high-speed passenger service rather than for freight service. They are also noteworthy in regard to the design and construction of the electrical equipment. The motors are bipolar gearless, the magnetic circuit, the field windings and the motor fields being integral with the locomotive frame, and spring supported, while the armature is mounted directly on the axle and is held centrally between the poles by means of the journal boxes sliding in finished ways in the side frames. The pole pieces are vertically tangential to the armature, so that the armature is free to move between them with ample clearness on the sides.

The conditions of service under which this locomotive is to operate are as follows: It is capable of making two regular successive trips of one hour each between the Grand Central station and Croton, a distance of 34 miles, with a total train weight of 550 tons, a single stop in each direction and a layover not exceeding 20 minutes. In addition a similar schedule can be maintained with a lighter train, making more frequent stops. Finally, with a total train weight of 435 tons it will make the run from the Grand Central Station to Croton, without stop, in 44 minutes, and with one hour layover will keep up this service continuously. This last is the schedule of the Empire State Express, although the latter is a somewhat lighter train.

The principal dimensions of the locomotive are as follows:

Weight of locomotive (with 9,000-pound heater), 93 tons; number of units, 1; horse-power rating of each motor, 550 horse-power at 625 volts; gearless. Arrangement of wheels, 8 driving wheels, and 4 leading wheels (of the latter, two at each end). Number of motors, 4. Weight on driving wheels, 66¾ tons. Total tractive effort at full load on motors, 22,000 pounds. Total tractive effort at starting up, assuming 25 per cent tractive coefficient, 33,500 pounds. Gage, 4 feet 8½ inches. Diameter of driving wheels, 44 inches. Diameter of truck wheels, 36½ inches. Length over all of locomotive, 37 feet 3 inches. Extreme width of locomotive, 10 feet 2 inches. Height to top of cab, 13 feet 11½ inches. Total wheel base (center to center of outside wheels), 27 feet. Wheel base of driving wheels, 13 feet. Driving wheel journal bearings, 14 inches x 7 inches diameter. Truck journal bearings, 12 inches x 6½ inches diameter.

The Sprague-General Electric multiple-unit control is used on this locomotive. There are two master controllers in the cab, so placed that the operating engineer looking ahead will always have one of these under his hand. The control system permits two or three locomotives to be coupled together in any order in which they happen to come, and to be operated as one unit by the engineer in the leading cab.

The control system is also semi-automatic in its action, as it provides check on the rate of acceleration of the train, which the engineer cannot exceed, while he may accelerate at any slower rate if he so desires. Should two locomotives break apart, the control current will be automatically and instantly cut off from the second locomotive without affecting the ability of the engineer in charge to control the front locomotive under his charge. The control system is designed for a minimum of 300 volts and a maximum of 750 volts.

The locomotive is provided with all the usual accessories of a steam locomotive, including an electric air compressor to furnish air for the brakes; it will have whistles, a bell and an electro-pneumatic sanding device, and electric headlights at each end. The interior of the cab is also heated by electric coils.

The locomotive has a maximum rating of about 2,800 horse-power, that is, a capacity in both output and draw-bar pull about 50 per cent greater than that of the largest steam passenger locomotive now in service. With a light train it will develop speeds up to 75 miles per hour, and with heavier trains similar speeds can be attained by coupling two or more locomotives together and operating them as a single unit.

The locomotive is in every respect a modern type of electric apparatus, and in simplicity and accessibility of its parts, as well as in the provision made to insure continuous operation with the minimum chance of failure, it marks a new and successful type of locomotive.

The International Railway Congress for 1905.

In May, 1905, the International Railway Congress will be held at Washington. The American Railway Association has unanimously voted $35,000 to defray the expenses connected with the meeting of the congress in this country. Congress has appropriated $400 for the same purpose.

The list of questions to be discussed at this coming session covers almost every phase of railway engineering. Section 1 will consider "Way and Works," and will devote its attention to wooden sleepers or cross-ties; the selection of species of timber used; and processes of preservation. Rails for lines with fast trains will also receive attention, such subsidiary considerations as the cross-sections of heavier rails, manufacture and inspection, the best metals to use for rails and ties, nickel alloys, rail joints, improvements in suspended joints, experiments with supported joints, experiments with a view to reducing the number of joints, and methods of preventing creeping being also discussed. Other subjects which will receive consideration are improved rail crossings (frogs), and concrete and embedded metal.

In Section 2 "Locomotives and Rolling Stock" is the subject assigned. Locomotives of great power, pooling locomotives, automatic couplers, and electric traction will be treated.

Section 3 will receive for its subject the "Working of Railway Lines," the topics including the lighting, heating, and ventilation of trains; automatic block systems; baggage and express parcels, and suburban traffic.

In Section 4, general topics which could not very well find a place in other sections will be discussed. Among these may be mentioned slow freight rates, bookkeeping, duration and regulation of work, and provident institutions.

Section 5 will consider light railways, and particularly the influence of light railways on the main lines, direct financial co-operation by public authorities, organization of a cheap service on a main railway's branch lines which carry little traffic and on light railways, and traffic conveyed by automobiles.

The Santos Dumont Prize for a Two Days' Voyage in the Air.

It will be remembered that Santos Dumont founded a prize of $800 just after he had won the Henri Deutsch prize by passing around the Eiffel Tower in his airship. The prize was to be awarded to the aeronaut who would start from the St. Cloud aerostatic park and pass around the Eiffel Tower, but without any limit as to time. Up to the present there has been no competition for the prize, as there are in fact but few airships in the field and these are more or less in the experimental stage. Accordingly, at the last meeting of the Aero Club, Santos Dumont decided to employ the prize in another way and it is now to be awarded for the first voyage lasting forty-eight hours to be accomplished with a spherical balloon or with any kind of airship. The prize can only be obtained by a member of the Aero Club and the start is to be made in the presence of two other members. Before engaging in his experiments with airships, Santos Dumont became an expert pilot of spherical balloons and is still interested in the question. It is therefore by way of encouraging this branch of aerial navigation that he offers the prize. No doubt it will not be an easy matter to realize an airship either lighter or heavier than air which will be able to remain forty-eight hours in the air. But such a performance, although difficult, can be carried out by a spherical balloon. No doubt this offer will be followed by a number of trials with ordinary balloons and will awaken renewed interest in the question of endurance.

The Current Supplement.

The English correspondent of the Scientific American opens the current Supplement, No. 1506, with an article on the Coolgardie Water Works, most fully illustrated. The Belgian correspondent of the Scientific American writes instructively on Thermo-Electric Receivers for Wireless Telegraphy and Telephony. Emile Guarini, by a series of valuable experiments, has endeavored to determine the influence of the electric tramway line, and especially of the rails through which the current returns to the generating station, upon a relay formed of a magnetized needle capable of revolving in a vertical plane and dipping at the time of the deflection into the mercury cups in which ends the local current, such relay being placed in ordinary practice a few inches from the ground. The results of his experiments are described in an article published in the Supplement. "Wool Conditioning in England" is the title of an article which shows how deception and fraud are detected in the British woolen and worsted trades. Charles E. Munroe discourses on the relations of technical chemistry to the other sciences. Dr. Somerville's excellent dissertation on scientific agriculture is concluded.

Automobile Notes.

The first practical demonstration of what an automobile can do, if fitted with steel-flanged wheels, and run on a railroad track, was made recently by Mr. Charles J. Glidden, of Boston, Mass. Mr. Glidden is on an auto tour of the world, in the course of which he has already covered over 20,000 miles, or about one-half the distance which he intends to cover in all during several months of the next three years. In the course of this trip he found it necessary to cross the American continent. The first 1,733 miles of this distance were traversed over the roads at an average speed of 18.13 miles an hour, while the second stage of 1,800 miles, from Minneapolis, Minn., to Vancouver, was run over the rails of the Canadian Pacific Railway. The 24-horse-power Napier car which Mr. Glidden drives was run as a special, and was in charge of a conductor all the way. The 1,800 miles were traversed in 60 hours' running time, and the Gliddens say that 40 miles an hour can be made on the rails without any discomfort. The general average speed throughout the trip was about 30 miles an hour, and the gasoline consumption was about half that needed for locomotion over the roads. The trip has demonstrated the applicability of the automobile to railroads, and probably in the near future railroad superintendents will have large and powerful automobile inspection cars propelled by gasoline motors, instead of the more cumbersome steam cars now used for this purpose.

A new type of automobile for transporting mail matter is now on trial at Paris under the supervision of M. Berard, Secretary of Posts and Telegraphs. The new cars are electromobiles and will be used for carrying the mail between the central post office and the various branch offices throughout the city. The present type of electric car, brought out by M. Dubois, has now been definitely adopted by the authorities and will soon replace the old postal wagons. By the middle of October it is proposed to place as many as 15 of them in service. The main advantage to be gained with the new cars is a considerable saving of time in making the trips between the offices; an earlier distribution of mail than heretofore can thus be made, and the hour of collecting, especially in the outlying quarters of the city, can be made later. The new system will bring about an improvement in collecting the mail which has been needed for a long time past. It is expected that the cars will run at a speed of 12 or 15 miles an hour within the city, but they can be run as high as 25 miles. Their total weight is less than 5,000 pounds. The wagon body, chassis, and motor weigh 2,000 pounds, the accumulators 1,250, two men 300, and the net load carried by the car is 1,400 pounds. A greater quantity of mail matter can be taken on the new cars in the proportion of 3 to 2. The electric motor is placed at the center of the chassis, and drives the rear wheels by chains. The accumulators will be charged by a special plant, which is being fitted up in the central post office.

A large number of motor bicycles were assembled on the occasion of the first annual race for the International Cup offered by the Motocycle Club of France. The cup was offered in order to promote the interests of motor bicycles and to bring together the leading makes of the different European countries, and the event was somewhat analogous to the Gordon Bennett Cup race as to its organization. The different nations were represented by 3 English makes, 3 French, 3 German, 2 Austrian, and 1 Danish. As to the types of machines, there were 5 two-cylinder machines and 7 single-cylinder. The event took place on the route near Dourdan, to the south of Paris; and the competitors were required to make five rounds on a circular route, or 125 miles in all. They started off at 20-minute intervals, led off by Lamberjack on a Griffon (French) machine. To the astonishment of the chauffeurs, the route had been plentifully sown with nails by some miscreants, and in many places the ground was entirely covered with them. This soon put the runners *hors de combat*, but it was not long before a volunteer brigade was organized and it swept the route clear with branches of trees. The race under these conditions was not the brilliant success it might have been. Most of the runners had to stop and repair their tires several times, and but few were able to finish. Demester (French) came in first, having made the five rounds in 3 h., 43 m., 43 sec. Next came Toman (Austrian) who had broken his saddle. The third was Inghilbert (French), who covered the last round in 39 m., 23 sec. Then followed Lamberjack (French) and Wondrick (Austrian). It was first proposed to annul the race, seeing the unfavorable conditions under which it was run, but the International Commission decided that it would hold good. The cup therefore belongs to France, for this year at least.

Correspondence.

The Uncleverness of "Clever Hans."

To the Editor of the SCIENTIFIC AMERICAN:

In your article of September 24, on page 213, you published an article on a reasoning horse, calculated to make your readers believe that Von Osten's stallion, "Der kluge Hans," "is really what his owner claims him to be, an intelligent four-footed animal, capable of making simple arithmetical calculations, and even of ratiocination." Your statement was based on a paper of Dr. Heinroth which appeared in the Illustrirte Zeitung.

I believe that it will be of interest to your readers to hear of a few facts which may serve to throw some light on the other side of the question. These facts are taken from the weekly edition of the Koelnische Volkszeitung (No. 36, September 8, 1904):

1. A watch was presented to "clever Hans." *Without condescending to look at it*, he immediately gave the correct answer by stamping eleven times—it happened to be 11 o'clock. I repeat, the animal did not even glance at the watch.

2. Mr. X, who was among the spectators, wrote an example of arithmetic on a slip of paper in such a way that no one present, not even the owner of the horse, knew the figures of the problem. The paper was then presented to the horse with the request to paw the solution. The animal started pawing *ad infinitum*. Mr. X exclaimed: "It's all wrong; the horse has passed the number by far." Whereupon the owner replied in an angry tone: "Why, of course; you must tell when the required number has been reached, or else you might as well ask the horse to sit down in a cab and take a ride!" There followed an excited scene, and "clever Hans" was led back to his stable.

3. On a certain wall near by, fourteen boys were sitting in two rows. Hans was asked by Mr. Schillings how many boys were sitting on the wall. *Without really looking in the direction of the wall and counting*, Hans pawed fourteen times.

4. Another time, a captain of the army gave Hans a very simple problem in addition, but made sure that his owner could not influence the horse. Hans failed completely. Then the owner got hold of him, and lo! Hans solved the problem correctly. (Koeln. Volksz. No. 36, p. 5.)

It is curious to note, moreover, that Hans must always paw the answers to the questions put to him. Take the following case. A picture is shown to Hans, representing one of the people before him. All present form a row and Hans is requested to point out the person represented. Now, why does Hans not simply walk up to the person in question? Why must he paw the answer?

Again, is it not strange that during the calculations Von Osten must feed the horse with carrots, if he would have him work. If Hans be intelligent, why should the honor of being admired by thousands of people and of being far above the common level of horses not, occasionally at least, be sufficient inducement for Hans to display his cleverness? Certainly, children of from twelve to fourteen years—and Hans is declared by his owner to have attained to the same degree of education as these—readily act from motives of ambition.

Besides, although Hans seems to have given correct answers in the absence of his owner, it is by no means certain that his owner is the only person who had a hand in, or at least is privy to Hans's training. Perhaps Mr. Schillings could furnish us with an explanation.

Finally, it is noteworthy that the Sixth International Congress of Zoologists, held at Bern on August 15 to 19, was requested by Mr. Schillings to investigate the matter. *A hearty laugh* was the answer of the learned men. They did not even call upon Dr. Heck and Prof. Matschie, who had been recommended by Mr. Schillings to report on the "reasoning horse," and some of them were impolite enough to relegate the circular submitted to them to the waste basket.

Such are some of the facts, dear Mr. Editor, which rather seem to justify those who, to quote your own words, "skeptically assert that his (the horse's) intelligence is simply the result of ingeniously concealed trickery on the part of his trainers."

H. MUCKERMANN, S. J.

Sacred Heart College, Prairie du Chien, Wis., October 23, 1904.

An automatic gas pump has recently been exhibited, constructed upon a plan enabling it, when set in operation, to run automatically, and to produce as perfect a Torricellian vacuum as is possible. It has been devised to provide a comparatively portable machine, suitable to special laboratory work, and for researches requiring prolonged pumping. A Röntgen ray bulb of a capacity of 200 cubic centimeters can be exhausted in thirty minutes.

Electrical Notes.

Some very interesting experiments have recently been made by an electrical firm at Geneva, in using continuous current at 70,000 volts for the transmission of power over the constantly increasing distances which are necessary for industrial purposes. The tests were made principally for the purpose of determining to what degree insulation will serve with continuous, as compared with alternating, current.

An improved electric relay has just been developed by Dr. Lee de Forest, which may be used in connection with an electrolytic wireless receiver to operate a sounder of the usual Morse telegraph type. Telegraph sounders have long been operated in relay with the coherer type of receivers, but heretofore all attempts at constructing a relay which would operate a sounder under control of the delicate electrolytic receiver have proved failures, and it has been necessary to use a telephone receiver in the relay circuit for detecting the wireless signals.

Our French contemporary L'Eclairage Electrique states that Bilbao is to be supplied with electric energy from three power stations situated at Quintana Martingalindez, Puentelana, and San Sebastian. At present the Quintana Martingalindez station is equipped with four 1,000-horse-power sets, consisting of a water turbine directly coupled to a three-phase generator. At a speed of 375 revolutions per minute the current is produced at 3,000 volts. The voltage is then raised to 30,000 volts, at which pressure the energy is transmitted to Bilbao, a distance of 50 miles.

The rapid growth of the American Institute of Electrical Engineers has been pointed out as an indication of the spread of the electrical industry. From a membership of about 1,250 in 1901, it has jumped to one of over 3,000 at the present time. These figures include all the different grades of membership, and the highest figures represent the lowest grade of membership, for which no technical examination is required. The American Institute of Electrical Engineers was organized in 1885, but the greatest accessions to the roll have been within the past few years. A very similar condition of affairs, although not so marked, is manifest in the other somewhat allied bodies, the American Institute of Mining Engineers, the American Society of Civil Engineers, and American Society of Mechanical Engineers.

Many are the efforts which have been made to separate the emulsified oil from the condensed feed water supplied to boilers, and it is doubtful if the result has ever been accomplished in a thoroughly practical and satisfactory manner until recently, when a process of doing this by the means of the electrical current was discovered. The ordinary means of performing this operation have proven inadequate, for the reason that the emulsified particles of oil are so exceedingly minute that they will pass through any filtering medium. There are chemical means of bringing about this result, but it is said that they are all open to objection. The electrical process referred to is known as the Davies-Perrett process, and in this the oily water is allowed to run over and under plates of iron which are placed vertically in a wooden tank. The plates are connected alternately to the positive and negative poles of a dynamo or battery, so the current passes from one plate to another through the flowing water. After this treatment the oil and water, which have entered the tank at one end as a milky liquid, pass out the other end with the emulsified oil coagulated completely. The water is then passed through wood wool, and then through a sand and sawdust filter, after which the water is beautifully clear, and it is stated that an analysis fails to show any indication of the oil. Such a plant, with a capacity of treating 3,500 gallons of water per hour, is now in constant use at an establishment in Tottenham, England, and is said to be performing its duties in a very satisfactory manner. In this case the treatment tank is 12 feet long by 2 feet deep and 2½ feet wide. The two filters take up less room than this.

Some remarkable results have been achieved with the Williams & Daft electrical ore-finder, which was fully described in the pages of the SCIENTIFIC AMERICAN a short time ago, by the discovery of valuable and extensive hematite ore deposits in the vicinity of Barrow in the northeast of England. For some time the output of hematite round Barrow has been seriously declining. In the case of one company the output has decreased from 16,000 tons a week to 2,000 tons, and it was feared that the deposits were exhausted. Repeated efforts have been made, in the hope of discovering new veins of ore, but without success, and as a final resource the electrical ore-finder was requisitioned by the Barrow Hematite and Steel Company. Owing to the fact that the conductivity of hematite is extremely slight, not much greater in fact than the conductivity of the ground itself, it was necessary to use specially-tuned instruments. A certain area was allotted for the purposes of the test. The ore-finder had not been long in use before it indicated the presence of hematite in large quantities. The Barrow Company decided to prove the accuracy of the divination, and boring operations at the points marked were commenced. Before the work had proceeded very far, the hematite deposit was encountered. A little deeper the hematite gave way to limestone; but contrary to the prevailing practice of abandoning boring when the limestone deposit was reached, owing to the theory that hematite did not exist below it, boring was continued in accordance with the findings of the ore-diviner. Finally, at a depth of 88 feet, which was approximately the depth indicated by the instrument, extensive deposits of the hematite were found. The vein struck is estimated to represent some 2,000,000 tons. Further divining operations are to be carried out, to ascertain the existence of other unknown layers in the vicinity. A new era of prosperity for Barrow is now realized, as illimitable quantities of the ore are to be obtained practically at the doors of the furnaces. Other valuable ore veins have been discovered by means of variously-tuned apparatus. New rich deposits of lead were indicated in Wales, and copper in Cornwall. It is also being used in Australia for prospecting gold, while special instruments have been sent to Mexico for the purpose of divining gold, silver, copper, and other mineral deposits.

Engineering Notes.

A deputation from the Paris Municipal Council left for Germany recently. In the course of the visit the delegates are to inspect the methods adopted for supplying water to Berlin, Hamburg, Frankfort, and several other large towns.

It is announced that the French government arsenals are now engaged in changing the sights of the Lebel rifle, in order to permit of the employment of a new bullet which will considerably increase the range of the weapon. Each arsenal can transform 300 rifles a day.

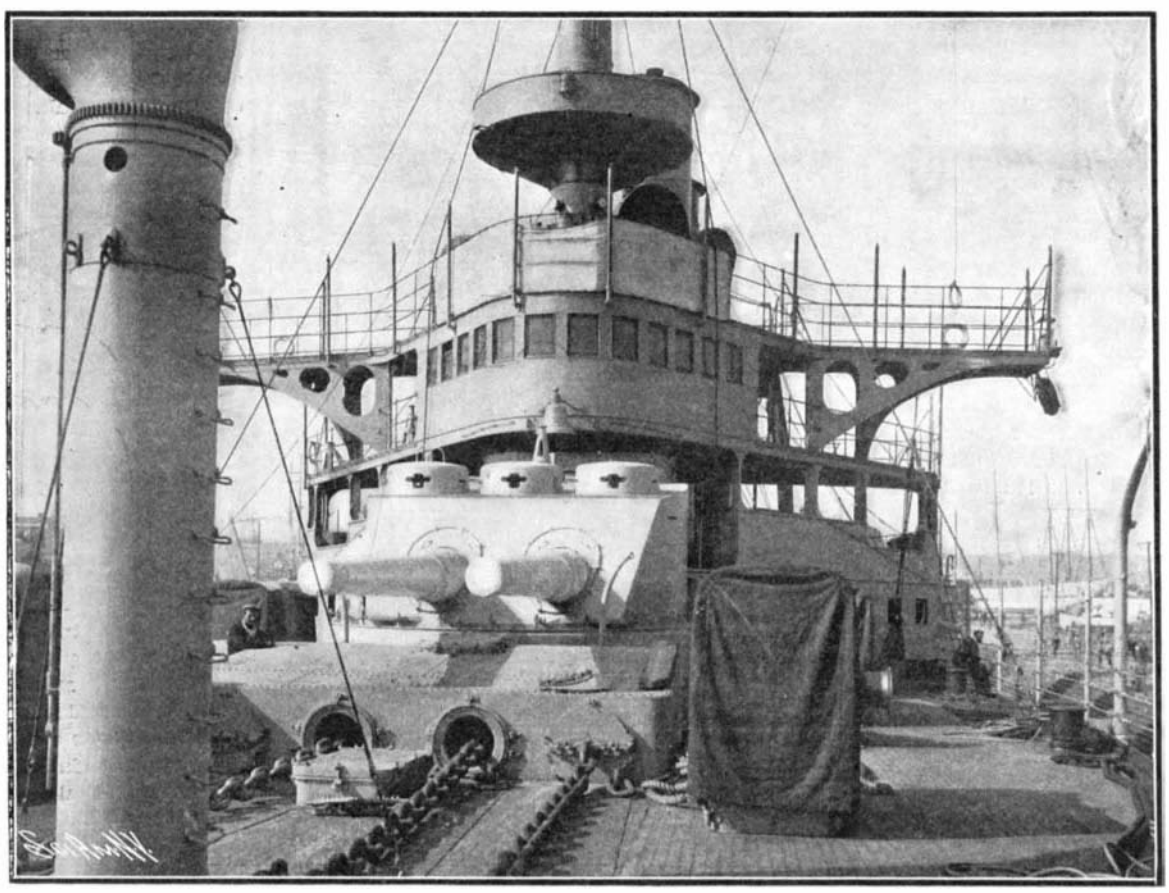
A great convenience for the draughtsman, which has recently been put before the public by an English firm, is a transparent drawing board, the feature of which is a plate of glass, one-quarter of an inch thick, which is sunk into a wooden frame so the edges of the wood and glass are quite flush with each other. Convenient bars are arranged across the apparatus, on which the originals to be worked over are fastened, and there is also a rest for the forearm of the draughtsman while at work. The board may be tilted at any desirable angle, and held at the proper point by two props, which fold up into the frame of the device when it is desired to pack it away. A mirror is swung under the glass, which can also be fixed at any suitable angle, and the light reflected by this can be made to strike under the work, and the task of copying a drawing thus made quite easy. Where there is a lack of light, the illumination may be supplied by means of a row of electric lights fitted along the edge of the board. The apparatus folds flat and is very portable.

It is claimed that the underground railroad of the city of Chicago will in a great measure relieve the congested condition of the streets of that city, not so much by the diversion of traffic below the surface, but by the removal of the great number of teams heretofore required to handle the freight traffic of the great western metropolis. The first instance of this kind has just been accomplished in an experimental manner by the transportation of the mails by this subsurface line instead of by horses, conveying the bags across the city from one depot to another. The entire transcontinental mail had to be transported in this manner, and much delay resulted incident to the exchange from the trains to the wagons and back again, independent of that which frequently happened to the wagons in the course of their trips through the thronged streets of the busy city. Connection has been established between the stations of the Lake Shore and Michigan Central and the Chicago, Milwaukee & St. Paul, and upon the completion of the work, the mails were transferred directly to the tunnel cars, and after being sealed were sent on their way. Their operation is largely automatic, and as the way is clear, no time is lost in transit. The company undertaking the contract agrees to cut the present time of handling the mail between the points named in half, but at the same time the officials are confident of their ability to do very much better than this. If the scheme proves successful, other connections will be made, and the mail to and from the main post office handled in this manner. This innovation, besides cutting down the time of mail transportation, will be the means of saving much money now spent by the government in the maintenance of wagons and horses. It will also place at the disposal of the Chicago postmaster considerable room about the post office structure, which is now given up to the purposes of a wagon stand. This is an item of some importance in this case, as there is a scarcity of room, and the space thus gained can be put to good use.

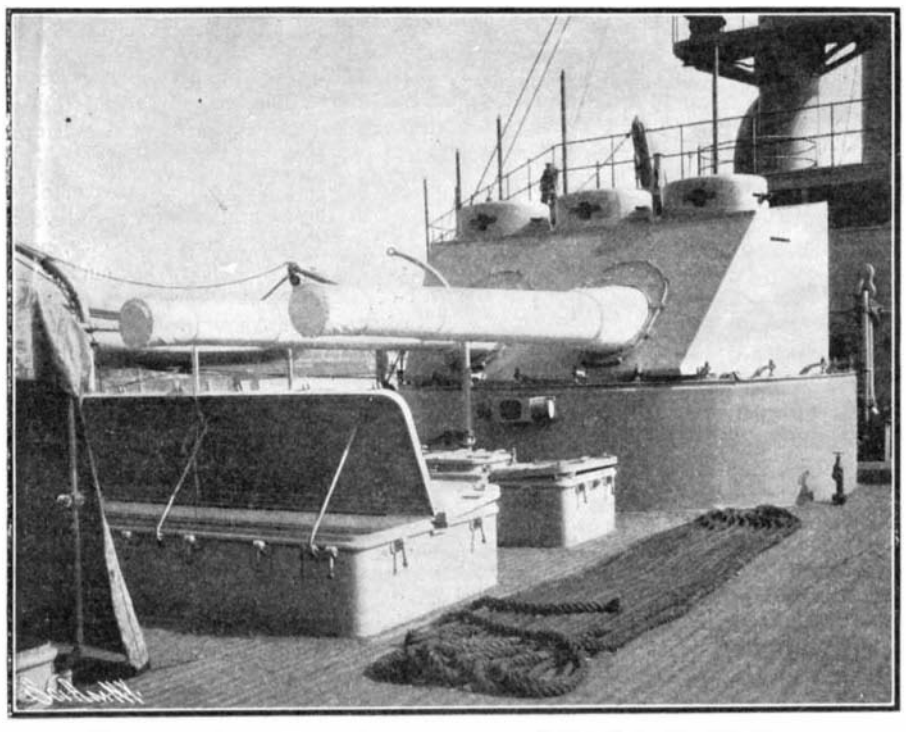
THE TRIAL TRIP OF THE ARMORED CRUISER "COLORADO."

The successful trial trip of the new armored cruiser "Colorado" over the Cape Ann course, in which the vessel averaged 22.24 knots an hour, marks this vessel as the fastest armored warship in the United States navy. Previously, the armored cruiser "Brooklyn," with a trial speed of 21.91 knots an hour, was the fastest vessel carrying side armor. The favorable outcome of the trials is particularly gratifying to navy officials, for the reason that the "Colorado" was the first to be put to the test of a large class of sister vessels in which are included, besides the "Colorado," the "Maryland," "Pennsylvania," "South Dakota," "California," and "West Virginia." That all of these vessels will have no difficulty in making their contract speed of 22 knots is further suggested by the trials held November 2 of the "West Virginia," which averaged 22.14 knots in running twice over the same course of 44 miles.

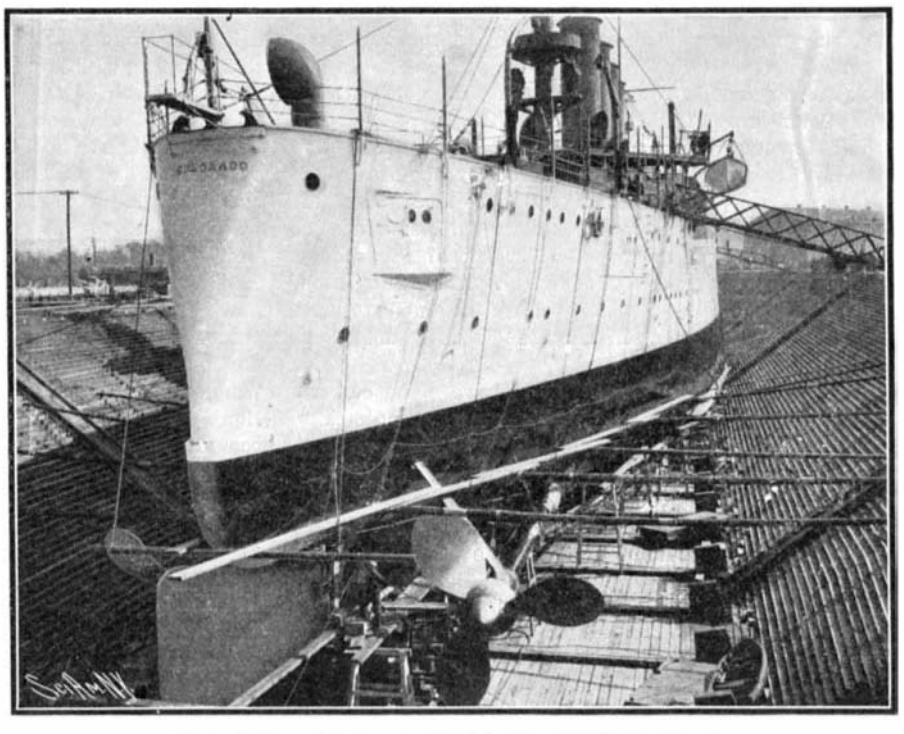
The "Colorado" is unquestionably the handsomest ship in the United States navy, and what we say of her in this respect, of course, applies to all six ships of her class. In the first place, because of her great length, she has much of the long, rakish appearance of a transatlantic liner. Indeed, as a matter of fact, she is longer than the famous Cunard liners "Umbria" and "Etruria," which were, at one time, holders of the transatlantic record. These vessels are just 6 inches shorter over all than the "Colorado," whose length over all is just 502 feet. In beam she greatly exceeds the "Umbria," measuring 69 feet 6½ inches as against 57 feet 2 inches; but her mean draft is, of course, considerably less, being 24 feet 1 inch, as against say 28 feet for the liner. When she is fully equipped for a cruise, and is carrying a normal coal supply of 900 tons, the mean displacement of the "Colorado" is 13,680 tons; but when her bunkers are filled to their full capacity of 2,000 tons, and the vessel carries her maximum supplies of stores and ammunition, her displacement is 15,138 tons, which is not so very far short of the displacement of the crack transatlantic liners "Campania" and "Lucania."



VIEW LOOKING AFT FROM BOW OF "COLORADO," SHOWING BRIDGE AND FORWARD PAIR OF 8-INCH GUNS.



VIEW ON QUARTER DECK, SHOWING AFTER PAIR OF 8-INCH GUNS.



STERN VIEW OF ARMORED CRUISER "COLORADO."

The "Colorado" is driven by twin-screw, vertical four-cylinder; triple-expansion engines, whose contract horse-power is 23,000, steam being supplied by thirty Niclausse water-tube boilers with a total grate area of 1,600 square feet and a total heating surface of 68,000 square feet. During the trial trip, the engines worked with remarkable smoothness and absence of heating, a clear indication of accurate workmanship both in the shops and by the erecting gangs. The average speed of 22.24 knots for the whole course of 88 miles does not express the absolute limit of the speed of the "Colorado," for on the trip from Philadelphia to New York, she indicated as high as 25,000 horse-power, and the speed rose to near the 23-knot mark.

The protection of the "Colorado" consists of a complete waterline belt, 7 feet 6 inches deep, which has a maximum thickness of 6 inches amidships and thins down to 3½ inches at bow and stern. Associated with the vertical belt is a continuous protective steel deck, which on the flat portions is 1½ inches in thickness, and on the slopes has maximum thickness of 4 inches, which is equivalent to at least 6 inches of vertical armor. If to this be added the protection afforded by the coal in the bunkers, representing an equivalent of a few inches more of armor, we have a total resisting power equivalent to, say, 14 or 15 inches of vertical armor, so that the shells, even of the heavier guns of the enemy, should find it difficult to penetrate to the boiler or engine rooms and magazines, except at the nearer ranges, and then only if the hits were made normal to the side of the ship. For about a third of the length of the vessel amidships, a wall of 5-inch armor is carried up to the level of the main deck, that is through the height of two decks, with athwartship bulkheads of 4-inch armor joining the ends of these side walls. Within this central battery, and mounted on the gun deck, five on each side, are ten 6-inch 50-caliber guns. They fire through recessed casemates, and are provided with semicircular shields fitting with a slight clearance against the casemate opening, the protection to the guns thus being very complete against shells of 6-inch and even heavier guns. To localize the destructive effects of projectiles that may enter the battery and burst inside, screens of 2½-inch steel extend inboard from the outer wall of armor. These reach back far enough to afford very efficient protection against the fragments of bursting shells that may enter from the side on which the particular batteries are placed.

The main deck extends flush throughout the whole ship, and upon this deck, above the four corners of the 6-inch battery, there are four casemates with 6 inches of protection, in each of which is mounted a 6-inch 50-caliber gun, capable of firing from abaft the beam to dead ahead or dead astern, the total arc of fire being 150 degrees. Between the 6-inch guns on each broadside on this deck are mounted four 3-inch 50-caliber guns, and on the gun deck are eight other 3-inch guns, four firing through casemates at the bow and four at the stern of the ship. The conning tower is protected by nine inches of armor, and the signal tower aft by 5 inches. The main armament of this fine vessel consists of four of the new 45-caliber, 8-inch, high-velocity rifles, mounted two forward and two aft in barbette turrets, the turrets being protected by 6 inches of armor with front port plates 6½ inches in thickness. The turrets are mounted above shallow barbettes, and armored ammunition tubes pass down from the barbettes to the ammunition rooms below the protective deck.

The important question of ammunition supply has been carefully worked out, and the guns are provided with the latest patterns of electric hoists, designed especially for our own warships. The guns in the main battery are electrically controlled. The electric hoists are capable of supplying two projectiles per 8-inch gun per minute; and for the 6-inch guns three projectiles per gun per minute, which is amply sufficient for the speed of fire that will be obtained during the stress of battle, when constantly-changing ranges and the many distractions of the fight will render impossible the high rates of fire which have been obtained with the same guns during target practice. The normal ammunition supply consists of 83 projectiles for each 8-inch gun, 132 for each 6-inch, and 166 for each 3-inch gun, the weight of the normal supply of the ammunition for all guns combined being about 700 tons. An interesting fact is that the total weight of armament on this ship is 2,219 tons, and the total weight of the machinery 2,100 tons.

As viewed in drydock at the Brooklyn navy yard, New York, previously to her trials, the "Colorado" made a very favorable impression. The contour and general proportions, although they are dictated, of course, by purely military considerations, nevertheless are, to the nautical eye, very harmonious and convey an instant impression of speed and power. The armament, according to the latest ideas, is somewhat

light for a ship of this displacement, the defect, if such it may be called, having been remedied in the latest ships of the "Washington" type, which will carry not only more and heavier armor, but a much more powerful armament. A careful inspection of the "Colorado" shows her to be apparently an excellent shipyard job; and there is no doubt that if this good work prevails through every ship of this class, the United States navy will receive a most valuable addition to its fighting power.

NOTABLE ST. LOUIS AIRSHIPS.

The newspapers within the last two weeks have had occasion more than once to comment upon the successful experiments conducted at the Louisiana Purchase Exposition with the Baldwin and Benbow airships, both of them craft built on the well-known lines followed by Santos Dumont.

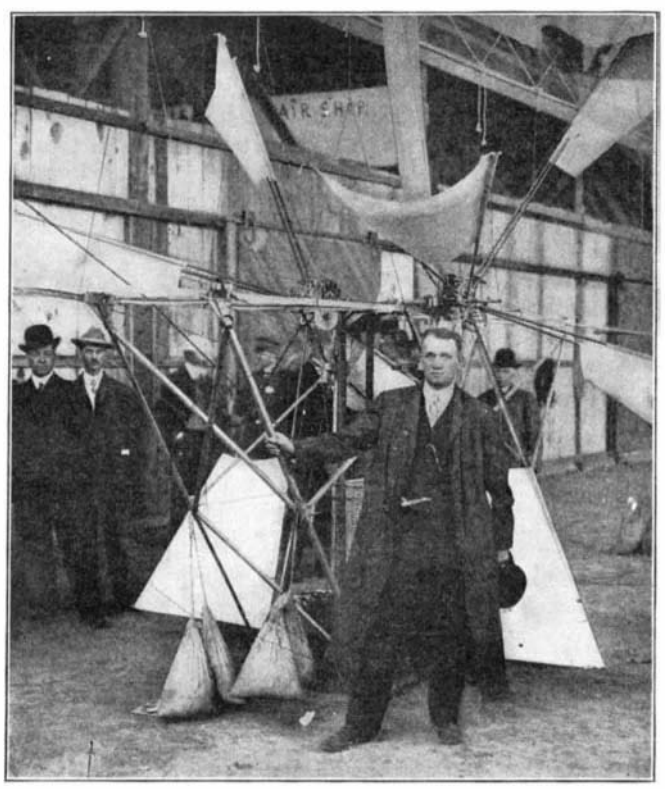
Baldwin's airship has been described with some fullness in these columns. For that reason it is necessary merely to give in this place a brief account of its performances. Manned by A. Roy Knabenshue, of Toledo, Ohio, its first ascent was marked by the execution of evolutions in a 10-mile northwest wind that rapidly increased to 18 miles. In the teeth of this breeze, the airship moved back and forth at a height of from 300 feet and upward over the Exposition grounds, and twice returned nearly to the point from which it set out. On the occasion of this first ascent, the spark of the gasoline engine failed to work, the propeller stopped, and the airship drifted helplessly in the wind. By shifting his own weight and by cleverly manipulating the rudder and ballast, the aeronaut succeeded in turning the craft around, and in raising and lowering it in the air to a considerable extent. He succeeded in alighting without injury to himself or to the machine. The second attempt, which was made on October 13, was still more successful. After circling in every direction at a height of 2,000 feet above the Cascades, the aeronaut returned to the place from which he started, covering 3½ miles, part of the way against an 8-mile wind. On the return trip the airship sailed slowly over the exact spot from which it had risen twenty-eight minutes previously, and glided about 100 feet farther west, where it alighted. The vessel in this breeze seemed to answer her helm well, and seemed to be under perfect control.

On November 1 a third successful flight was made, high above the western portion of the Exposition grounds, the journey ending in the Stadium, adjoining the Aerial Concourse. The airship rose to an altitude of 1,600 feet, and descended upon the exact spot where the aeronaut had decided to land.

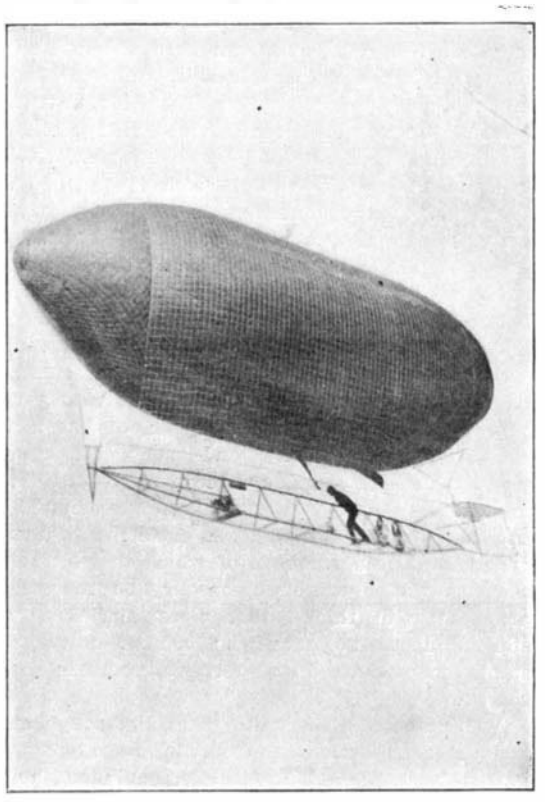
The last trip of the Baldwin airship ended unfortunately. After two accidents the airship started, broke away, and went a long-distance flight on its own account. After the aeronaut had descended to repair an exhaust cap, the airship broke away. The airship was found later sixteen miles west of St. Louis. It was uninjured by its wild night flight except for two small rents in the gas bag.

Another airship of promise is that invented by a Montana man, Mr. T. C. Benbow, in collaboration with Mr. H. J. Wells. The Benbow dirigible balloon is constructed on somewhat different principles from Baldwin's. It is much larger, the cigar-shaped bag being 74 feet long and 21½ feet in diameter, having a capacity of 14,000 cubic feet and carrying a weight of 900 pounds. Directly beneath the central line of the gas bag, and attached to its cords, is a horizontal spar, made of steel with the exception of a short prolongation of bamboo aft, to which the rudder post is attached. To this rod is suspended a framework of aluminium suspended by steel rods and stiffened with piano wire. The car is prolonged fore and aft into long beaks, similar to and parallel with the main spar. It is divided into two compartments, the forward one containing a 10-horse-power gasoline engine, and the other a rectangular wicker basket in which the aeronaut stands. This arrangement, it will be observed, is rather similar to that adopted by Santos Dumont. The engine is kept cool by means of an electric fan. The propellers are geared to the engine by a belt and pulley. Each propeller is composed of four 6-foot blades or wings, made of canvas stretched on bicycle tubing and braced with piano wire. The vanes are collapsible, and by an ingenious mechanical device are made to close up at each revolution, remaining open just long enough to seize and grasp the air, and presenting a minimum resistance while returning to the point of the greatest efficiency. An aerial propeller is thus constituted, not unlike the feathering paddle-wheels found on many river steamers. By this peculiar application Benbow hopes to obtain the motion of the human hand in swimming, the change of position of the vanes on the feathers of birds during flight being also imitated. The operation of the vanes may be modified by means of a crank placed conveniently to the hand of the navigator. These are to cause the vessel to ascend or descend at will. While vertical trimming is thus controlled by causing the opening and closing of the vanes to take place at

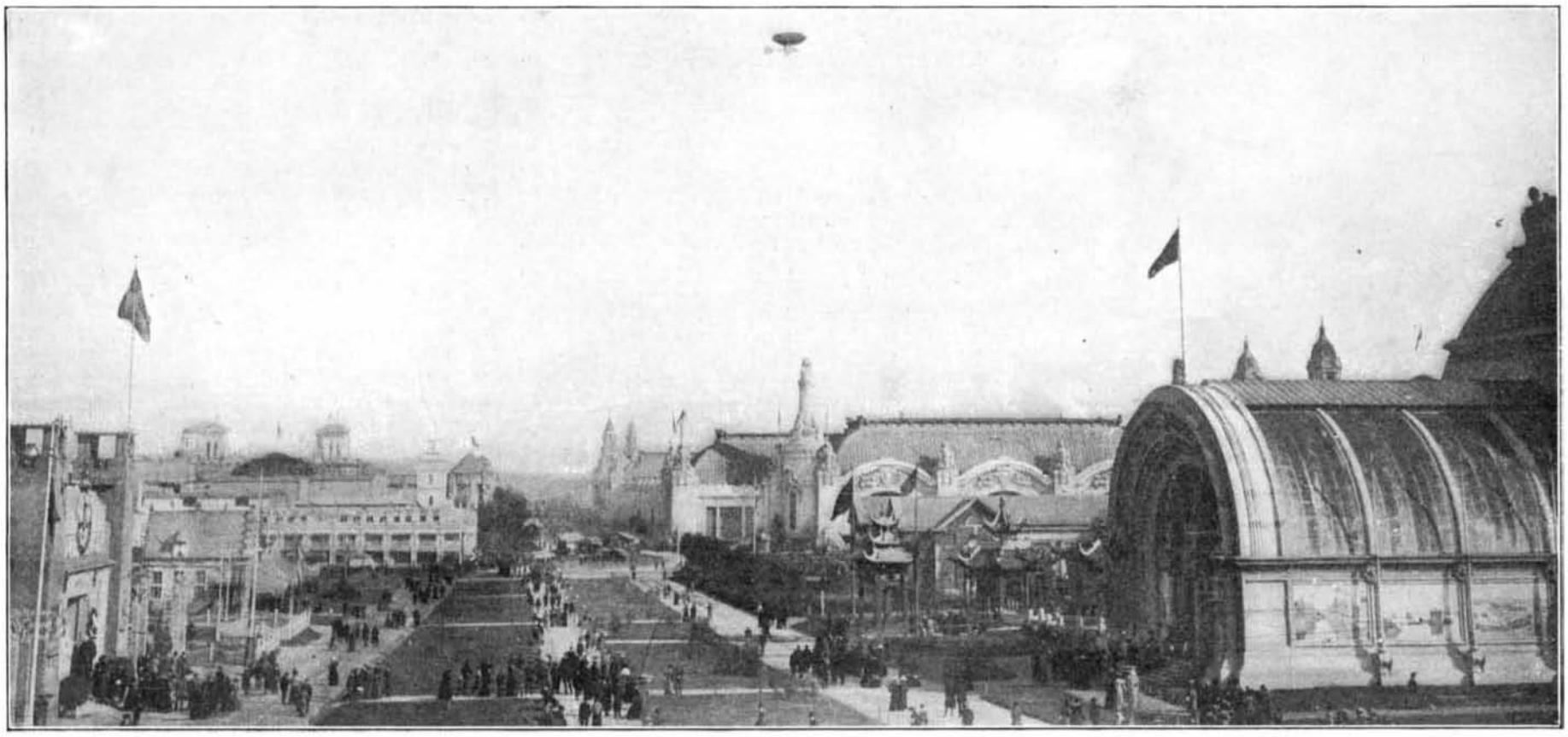
The Ascent of the Benbow Airship.



Benbow Standing Beside the Propelling Machinery of His Airship.



Baldwin's Airship Under Way.



Baldwin's Airship at a Height of 600 Feet Above the Exposition Palaces.

NOTABLE ST. LOUIS AIRSHIPS.

different points of their revolution, the horizontal direction is governed by means of a cord attached to the rectangular rudder, 8 feet by 5 feet, made of canvas stretched on a bamboo frame.

On September 7 Benbow made his first flight from the Aerial Concourse. His bag having been filled with impure gas, it was necessary for him to sacrifice half of the propelling power and part of the ballast ordinarily provided. For this reason his first attempt may be considered largely in the nature of an experiment. The second attempt was more successful.

The Mürren Cable Railroad in the Swiss Alps.

One of the most remarkable railroads, that constitute such a feature of railroad communication and construction in the Swiss Alps, is that connecting Lauterbrunnen with Mürren. The former township, which is in the valley, is the terminus of the Bernese Oberland railroad, connecting Lauterbrunnen with Interlaken, and forming part of the Bern-Mürren trunk line. Mürren, however, is a small Swiss village situated in the Bernese Oberland, 5,385 feet above sea level, on the opposite side of the valley which is crowned by the Jungfrau. The mountain side is particularly steep, and the railroad stretches from Lauterbrunnen to the Grütsch Alp, 4,890 feet above sea level. Its terminus constitutes one of the most remarkable engineering feats in Swiss railroad engineering.

The track has a striking resemblance to a ladder, so sharp is the angle of the gradient. The mountain face is very rugged, abounding with small, sharp ravines, through which the mountain torrents rush toward the lower-lying country and river, which extends through the valley. The consequence is that in order to negotiate these undulations in the ground, it was necessary to erect viaducts, so as to insure a uniform gradient. These viaducts, of which there are several, are constructed of rough masonry on the small-arch principle with thick, stout piers carried to a substantial depth, to obtain sufficient rigidity to withstand the pressure of the torrent waters in the rainy season.

At other places the track extends through cuttings, and the ballast removed from these sections was employed for strengthening the embankment at points not too well served in this respect. Upon the inclined plane thus constructed the railroad is laid. The rails are carried upon transversely-laid sleepers. There is only one track; but as the railroad is operated upon the simple though highly efficacious principle of raising a pendant weight by the connection of a heavier one upon the other end of the attachment, there is a half-way station, where the ascending and descending cars pass, and at this point the track resolves itself into two loops.

The total length of the railroad from Lauterbrunnen to the Grütsch Alp is 4,530 feet, and the average gradient is 55 in 100, with a maximum of 60 in 100. Down the center of the track is laid a rack rail, in which runs a cog wheel carried underneath the car, which not only greatly assists the car in climbing, but in the descent acts as a highly efficient restraint over the force of gravity.

The railroad is operated by cable, the ascending car being connected by a wire rope, which passes over a drum in the power house at the summit, and thence to the descending car. The cables furthermore are water-balanced. Large pulleys are placed at frequent intervals to carry the cable.

The cars are self-contained, and start from the opposite ends of the road simultaneously, telegraphic communication being maintained between the two termini for purposes of signaling. Each car carries a water-ballast tank, but only the descending tank car carries the water ballast charge, in order to impart the necessary momentum to overcome the inertia of the car stationary at the lower station. As the car descends, water is gradually emptied from the tank. The displacement of the water coincides with the weight of the cable, which lengthens as the ascending car approaches the top. The skillful manipulation of this water ballast constitutes one of the most important factors in the safe operation of the railroad. Each car must travel at the same speed, and progress must be steadily maintained, so as to obviate any sudden jerks, which would throw severe strains upon the cable. Upon each car is attached a time indicator, and the rate of progress is regulated by the authorities. In order to guard against any inadvertent acceleration in the velocity, a powerful automatic brake is supplied to each car. Should the speed exceed that which is prescribed, the brakes come into operation, and thus check the engineer's progress. As a further precaution against careless or reckless driving, the engineer is subjected to a scale of fines, which are rigorously enforced by the authorities, information concerning this point being supplied by the time indicator.

To guard against any disaster resulting in the remote possibility of the cable rupturing, and to prevent the car running away and getting beyond control, each vehicle is equipped with two powerful brakes in addition to the automatic brake, and these are sufficient to hold the car stationary in conjunction with the rack wheel placed beneath the car, upon any part of the gradient. Accident is thereby adequately provided against, and it is this careful braking system which is responsible for that element of safety so characteristic of these mountain railroads in Switzerland. The cars pass each other half way, by the loops provided for the purpose, and at this point the cars make a momentary stop.

The cable has a breaking strain of 62 tons, and it is a splendid testimony to the care used in making it, that the same rope is in use to-day as when the railroad was first opened. The cable is thoroughly inspected at frequent intervals, and not even the weakening of a single strand has been discovered. The cars travel at the rate of 226.35 feet per minute, the whole journey occupying 20 minutes. This rate of progress is much greater than that attained by the locomotive-operated mountain railroads, such as the Rigi, where the speed is only 186.35 feet per minute, and the maximum gradient in three miles is 48 in 100. There is one other important cable-operated railroad in the Swiss Alps, that at St. Beatenberg. This railroad, which also has a maximum gradient of 60 in 100, is 12,795 feet in length and occupies 50 minutes to negotiate. Though the Mürren railroad is of practically the same gradient throughout, the St. Beatenberg track at one section has only a rise of 34 feet in 100, to cover which occupies 15 minutes.

From the Grütsch Alp station extends an electric railroad of the conventional overhead trolley type to Mürren. During the whole of the journey to the latter terminus, a distance of 3¼ miles, the railroad has only to climb 495 feet, the gradient thus being a comparatively easy one. The train is hauled by an electric locomotive. The whole journey from Mürren to Lauterbrunnen, including the negotiation of the cable section, occupies 55 minutes, and the fare charged is 75 cents.

The Largest Fruit Steamer.

The steamship "San Jose," the latest acquisition to the fleet of the United Fruit Company, arrived in Boston recently on her maiden trip from Port Limon, Costa Rica. The entry of the "San Jose" into this service is fraught with more than usual interest, from the fact that she is the largest fruiter ever constructed for service between the West Indies and the United States, and is also the first vessel equipped with refrigerating machinery to arrive at that port, which enables her to make long passages with perishable cargoes.

The keel plate of the "San Jose" was laid at the shipyard of Workman, Clark & Co., Belfast, Ireland, about nine months ago. The Fruit Company contracted with these builders for the construction of three steamers of the same size, all for this trade. The "San Jose" was the first to be launched. Her general dimensions are: Length between perpendiculars, 330 feet; length over all, 345 feet; breadth, molded, 44 feet 3 inches; depth of hold to the upper deck, 31 feet 3 inches. She is rigged with two pole masts, has three complete steel decks, also topgallant, forecastle, and orlop decks of wood, the latter extending throughout the forward part of the vessel. The engines and boilers are inclosed at all the decks by steel casings.

The novelty in the ship is in the introduction of refrigerating machinery. The cargo space is divided into separate compartments by steel bulkheads, which extend to the upper deck. All these holds and 'tween-deck spaces are insulated, and a very complete and efficient system of refrigerating machinery, with air ducts to every compartment, for the preservation of the fruit during shipment, has been fitted. By this means a low temperature can be secured in the tropical climates, and the fruit landed here in the best possible condition.

Each hold is fitted with a large hatch, supplied with the necessary steam winches, derricks, and special appliances for the expeditious and careful handling of the fruit cargoes.

A large steel deck-house has been built on the upper deck amidships, and at the fore end of this house is placed a dining saloon, with the passengers' staterooms opening on each side. A stairway from this saloon leads up to a steel deck-house on the promenade deck above, in which are additional staterooms and a smoking room. Rooms for the engineers and officers are provided in the midship deck-house, and the quarters of the crew are in a deck-house at the after end of the upper deck.

The spacious saloon is paneled in polished oak in a handsome manner, and is furnished with sofas, revolving arm-chairs, etc. The floor is covered with Brussels carpet, while the chairs and sofas are upholstered in moquette. The staterooms are finished in white enamel, with comfortable sofas, running water, etc., and are richly carpeted. The smoking room and other apartments are prettily furnished, and the lavatories are finished in white enamel with tiled flooring, etc.

The framing of the vessel consists of main and reverse frames of angle steel, to the entire exclusion of web frames except in the engine and boiler spaces. The stem is of rolled malleable steel carried above the forecastle deck. She is provided with bilge keels to minimize the motion of the ship, and her cellular bottom is divided into four compartments. She has steam steering gear and electric lighting plant, and carries a powerful searchlight.

The machinery consists of a set of triple-expansion engines of the latest type, with all the auxiliaries necessary for a modern steamer. The cylinders are 25, 41, and 68 inches in diameter, with a 48-inch stroke. Steam is supplied by three steel cylindrical multitubular boilers, 13 feet 6 inches in diameter, 11 feet 6 inches long, each with three furnaces, and having a total grate surface of 150 square feet, while the heating surface is about 6,000 square feet. The working pressure of the boilers is 190 pounds to the square inch. The "San Jose" was constructed under the supervision of the British Corporation Surveyors, and qualified for their highest class.

This immense fruiter calls attention to the evolution in this particular branch of our commerce. In 1870 Capt. Lorenzo D. Baker conceived the idea of bringing bananas to Boston from Jamaica, and with the comparatively small schooner "Telegraph" he made his first venture in this trade. For several years schooners made occasional trips between Jamaica and Boston, bringing small cargoes, which found a ready market here. In the early eighties the auxiliary steamers "Jesse Freeman" and "Lorenzo D. Baker" were placed in the trade, and later these were followed by more modern boats, especially built for the trade. The business made phenomenal strides, and at the present time the United Fruit Company own or have under charter a fleet of seventy-five steamers plying between their own plantations in Costa Rica, Colombia, San Domingo, Jamaica, and Cuba. Lines are operated to New Orleans, Mobile, Baltimore, Philadelphia, and Boston, and the fleet includes some of the finest vessels in the West India trade.

The "San Jose" on her trial trip exceeded her speed requirements; and while her speed is less than vessels of the greyhound class, it is ample to enable her to make excellent time between the fruit-producing countries and Boston, her great size insuring that she will keep time irrespective of the weather with the precision of the average railway train. The vessel has a capacity for 45,000 bunches of bananas.

The steamer "Limon," the second of the trio, has been launched and is now about ready for commission, while the "Esparta" will leave the builders' yard in a few weeks.

Iridium Lamp Filaments.

The objection to carbon filaments—disintegration, fusing with strong currents, and therefore waste of energy through the necessary employment of weak ones—have led to many attempts to construct a filament of greater efficiency and durability.

In the infancy of incandescent lighting experiments were made with metals of the platinum group. These experiments have lately been resumed, the greatest hope of success being placed on osmium. But osmium is by no means unobjectionable. Like carbon, it vaporizes at bright white heat, and if air is present, as in an imperfectly exhausted bulb, it forms hyperosmic acid which, even in very small quantity, is exceedingly injurious to the lungs and the eyes. Similar objections apply to ruthenium. Iridium is the only member of the group which is neither vaporized nor oxidized at white heat. Fused iridium is free from osmium, ruthenium, and palladium, which are vaporized during fusion.

Edison has recommended filaments of iridium wire—but the metal is extremely brittle and cannot, according to Guelcher, of Charlottenburg, be drawn into wire. With care it can be rolled into strips 1-32 inch thick, but it is impossible to make such a strip of either circular or uniform cross-section.

Guelcher has, however, succeeded in producing round and uniform iridium filaments by mixing fine iridium powder with vegetable glue, forcing the paste through a perforated plate by hydraulic pressure, drying the filaments and heating them to whiteness in an oxy-hydrogen flame. The filaments thus produced have a bright metallic luster, and though very hard, are flexible enough to be used in electric bulbs. They are said to be very durable and economical of power.

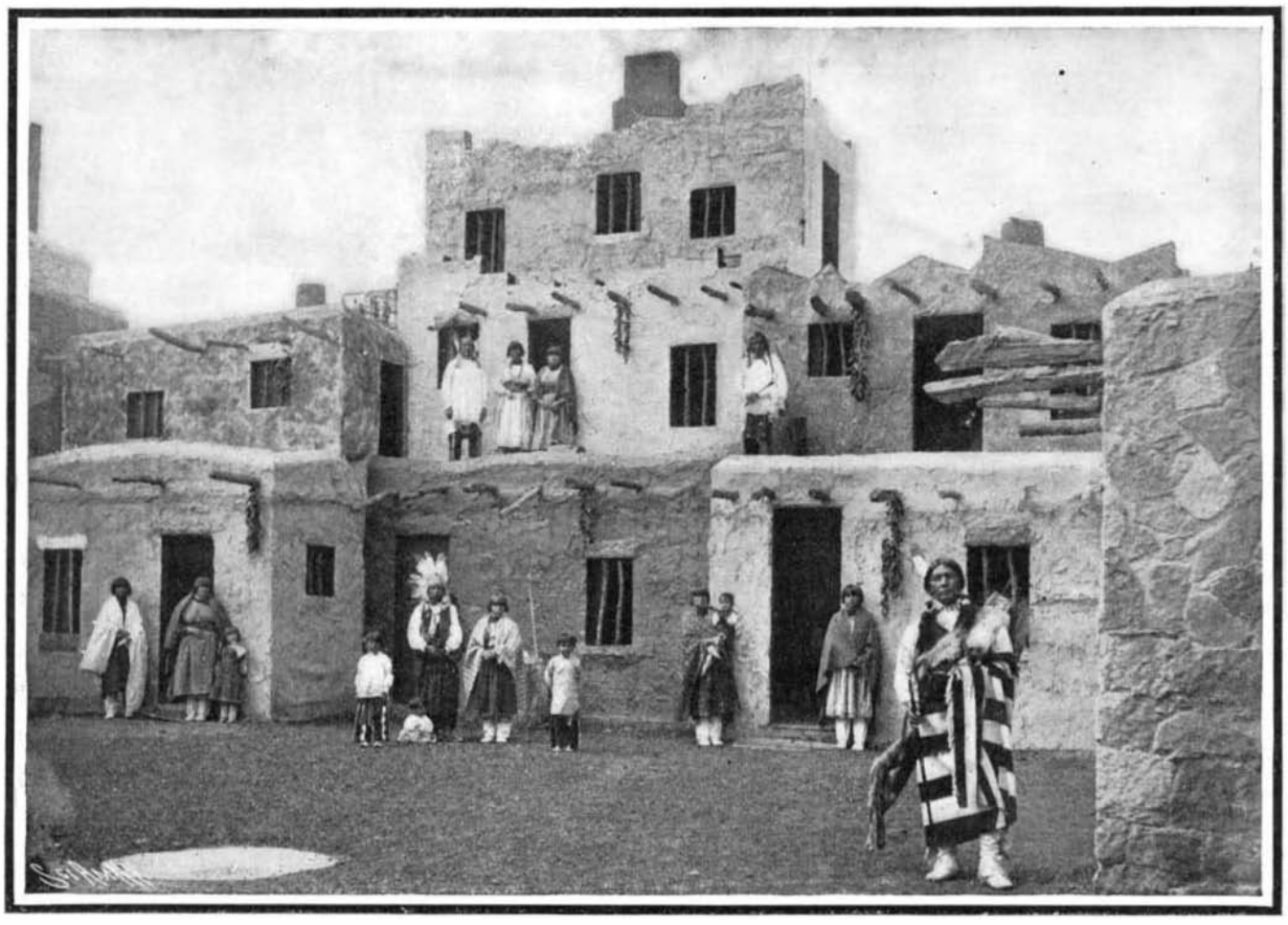
Instead of the chemically-pure metal, iridium powder as precipitated from solutions may be used. As this contains some oxide, the filaments, before being heated, must be exposed to the action of a stream of hydrogen.

Without this precaution they would explode on being heated. It should be noted that the heating must be done in an exposed flame, not in a covered crucible or a bed of charcoal, as the object is to effect complete combustion of the adhesive and leave nothing but pure iridium.—Condensed from Umschau, Prof. Russner, December 26, 1903.

THE CLIFF DWELLERS AT THE ST. LOUIS EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the most interesting of the aboriginal tribes of North America are those strange people the Mokis and Zunis, who, as far back as human records go, are known to have occupied the so-called Painted Desert in Arizona. By the enterprise of one of the concessionaires at the World's Fair at St. Louis, there are now being exhibited several hundred of the cliff dwellers, as they are popularly known, in an exhibit which makes a praiseworthy and very successful attempt to reproduce the conditions under which these people live. Like every other tribal exhibit at St. Louis, this one is thoroughly genuine, the tribes represented having come direct from their strange cliff dwellings, high up beyond the mesa, to take up their abode, during the continuance of the fair, in the extensive reproduction of their homes in the far Southwest. The large company of Zuni and Moki Indians gathered in this exhibit forms an ethnological exhibit of rare interest. As will be seen from our illustration, the reproduction of the native dwellings has been carried out with no little fidelity, and in the various rooms the two tribes are to be seen daily engaged in the arts of peace. They weave rugs that vie with those of the Navajo Indians in beauty and durability; they exhibit their skill in the making of a peculiarly beautiful beadwork; others are engaged in the weaving of hammocks, the sewing of moccasins and clothing, and the manufacture of silver jewelry, in which the Mokis are particularly expert. A curious characteristic of these people is that they are singularly skillful in mimicry, many of them being natural actors of no small ability, and they give exhibitions in a theater within the village. Among their daily performances, one that naturally attracts the most attention is the snake dance, which has been aptly described by a well-known ethnological student as an "unparalleled dramatic pagan ceremony." It takes place but once every other year, and during its performance they implore their deity, Gitche Manitou, for much-needed rain. Previous to the giving of these performances at St. Louis this tribe has never before performed its snake dance elsewhere than at Wolpi, in the Painted Desert of Arizona; and it is only within the past few years that even the existence of this extraordinary ceremony has come to the knowledge of the white man. As late as 1897 a few hunters and trappers, with some government *attachés*, were reluctantly given permission by the performers to witness the ceremony. Since that date the snake dance has grown in notoriety; and it is now seen biennially by several hundred Americans who make the long journey over a rough and inhospitable country for the purpose.



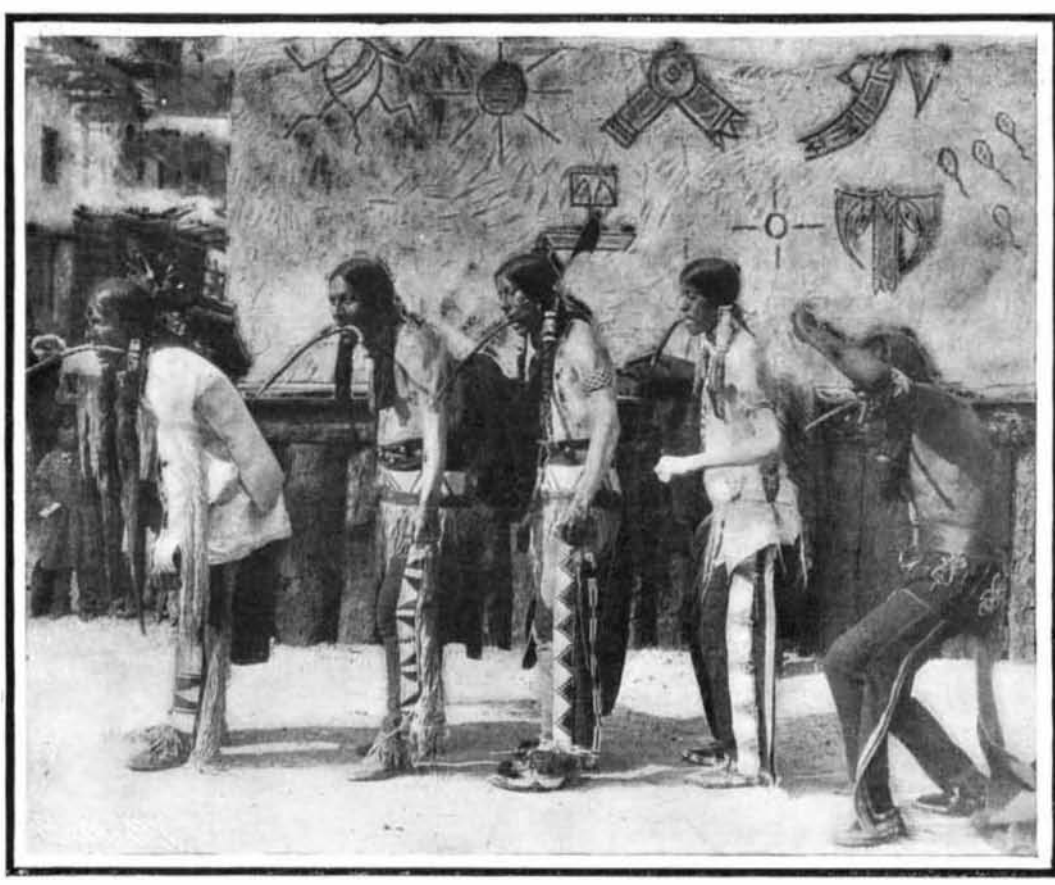
Reproduction of Cliff Dwellers' Village

It took a great deal of tact and a free use of money to induce the cliff dwellers to leave their homes for St. Louis, there being a suspicion among them that for the Zuni to leave the region of Wolpi means that he will never return to it again. They dance the snake dance on the stage of their small theater, dressed in their full savage regalia. Armed with strange implements and chanting wild themes to the rhythm of their drums, they go through their uncanny dance apparently charming into quiescence or stupor dozens of the deadliest snakes in which their region abounds, until they place the reptiles in their mouths and carry the dance to its climax. The sight is one of the strangest and most weird to be seen at the St. Louis Exposition.

A Balloon Equipment for the Russian Army.

The departure of Col. Kowanyko, the chief of the military aerostatic establishment of Russia, with a balloon outfit for Manchuria, is announced. He takes with him eight balloons, which are to reinforce the Russian aerostatic equipment on the scene of operations at present. The detachment under his command is charged with transporting the hydrogen generators for the balloons. These generators have been constructed on a special plan in view of making them easy to transport over a long distance. The gas is obtained by using a bath of caustic soda, and into it is plunged an iron cage containing scrap aluminium. The apparatus employs 2 pounds of aluminium, 2 pounds of caustic soda, and 1.3 gallons of water to obtain 35 cubic feet of gas. While the system is advantageous on account of the small space it occupies and the rapid production of hydrogen in large quantities, the process is a very expensive one, as 1 cubic meter (35 cubic feet) costs about $1.50. Owing to the lightness of the apparatus, the cooling of the gas is somewhat neglected. However, under the special conditions in which it is to be used, it will no doubt render considerable service.

The question of cutting a canal from Vienna to Trieste is being seriously considered. The assistance to commerce by enabling goods to be carried by water with its cheap freightage will be enormous.



Moki Indians Dancing with Live Snakes in their Mouths.

Group of Cliff Dwellers; the Indian to the Right is 98 Years Old.

THE CLIFF DWELLERS AT THE ST. LOUIS FAIR.

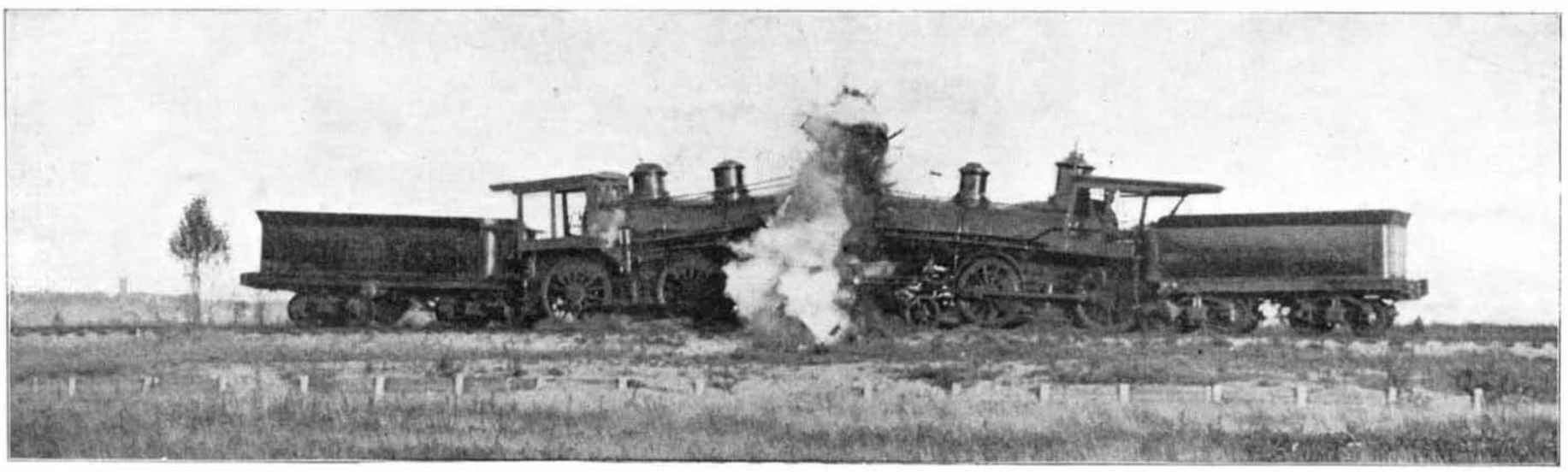
A LOCOMOTIVE DUEL SCIENTIFICALLY CONDUCTED.

BY DAY ALLEN WILLEY.

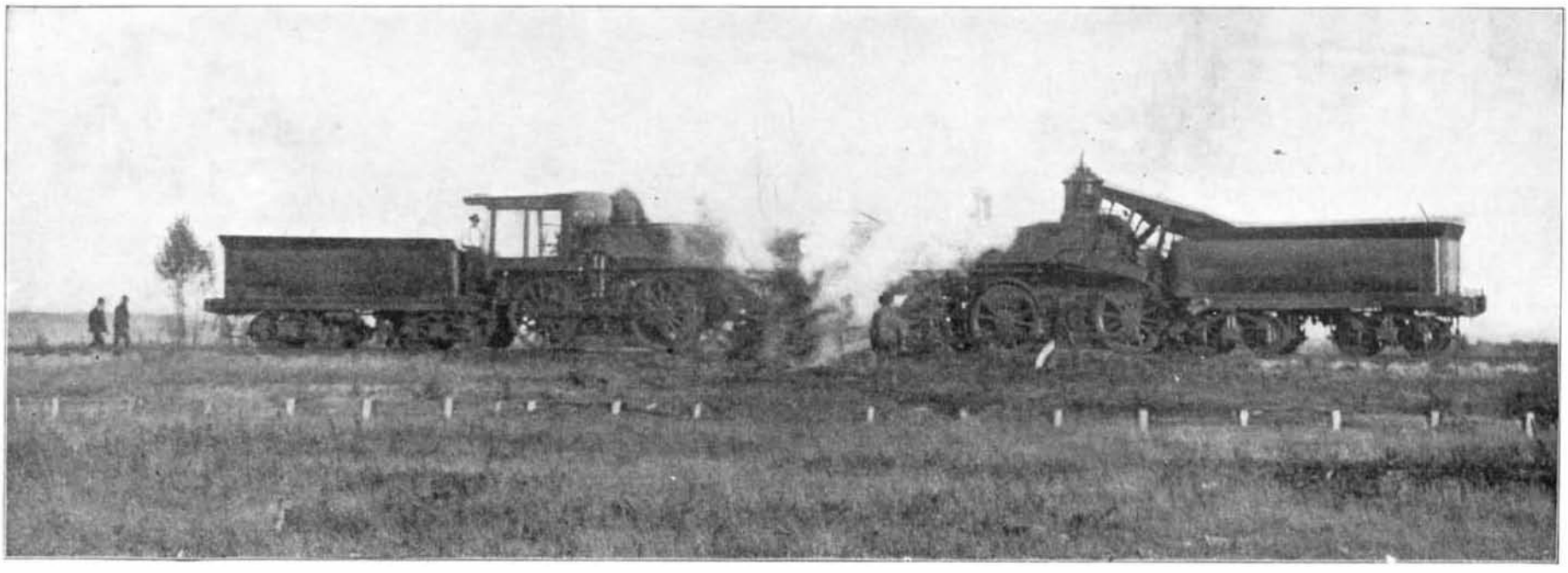
In spite of the too frequent railroad accidents, especially collisions which occur in this country, the opportunity is seldom afforded to note just what occurs at the time of impact when locomotives come together. The witnesses of such disasters are usually too excited over the occurrence to observe the immediate effects of the shock, and even if mechanical experts able to observe intelligently, they have only a chance to glance before the force developed at the time of contact has expended itself.

The accompanying illustrations are of unusual interest, for they depict a collision at the instant the engines struck each other and their condition a few minutes later when the motion had entirely ceased. Fortunately the photographer had a lens of high power and a very rapid shutter, so that even the fragments which flew into the air were reproduced on the negative as well as the jets of escaping steam and smoke. It may be needless to say that this collision was not an accident. It was one of several which have been arranged for exhibition purposes, but from it an opportunity is given to obtain valuable data as to the effect when two engines meet "head on" as in this instance, in start being given the engine shown on the right side of the illustration. It will be noted that when it struck, none of the wheels was lifted from the rails. The truck of the left engine, however, was forced above the track, and the front part lifted a foot or two. The shock also broke one of the steam pipes leading into the cab, which accounts for the jet of steam shown in the picture. It will be noted that the cab of the right engine was torn from its fastenings by the blow, although the other cab was uninjured. A curious feature of the collision was that after the first impact, there appeared to be a rebound, the engines then closing up again and the right engine slowly forcing the other backward.

The locomotives remained in motion for about three minutes after the impact, the one on the left being driven back nearly 50 feet from the point where they came together. An examination showed that its smokestack was torn away at the base and the front of the boiler broken so that the steam entirely escaped through this vent and the pipe in the rear in five minutes. In both cases the pilots were demolished as well as the forward woodwork of all kinds. The lantern standards, headlights, and all of the lighter ironwork, including hand rails, were broken and twist-



SNAPSHOT OF A LOCOMOTIVE DUEL. THE RIGHT-HAND ENGINE HAD A GREATER MOMENTUM THAN THE OTHER AND LIFTED ITS RIVAL FROM THE TRACK.



THE TWO ENGINES, IMMEDIATELY AFTER COLLIDING, APPARENTLY REBOUNDED, AND THEN CRASHED TOGETHER AGAIN.

for their position at the actual period of colliding has been clearly reflected by the camera.

For the mechanical "duel," as it might be termed, a section of track 5,600 feet in length was laid on a level grade at Point of Pines, Mass. The locomotives utilized were secured from a railroad company which had discarded this type for heavier equipment, but they were not defective or disabled in any respect except that their cabs had been replaced. The weight of each engine, including tender, was about 50 tons and they were modeled after the same specifications, each having four 60-inch driving wheels, and four truck wheels supporting the forward portion of the boiler. Prior to sending them together, steam was generated for two hours and the engines "exercised" so to speak, by moving them slowly up and down the track. Finally the boilers were subjected to as much steam pressure as the engineers deemed safe and each machine was backed to its end of the line. The engineers took their places in the cabs and at the signal arranged each opened the throttle to the limit and pushed his lever to the full-speed mark, then leaped to the ground. One locomotive attained a slightly greater momentum than the other engine. Consequently the point of contact was not midway between the terminals, but about 300 feet distant, the advantage ed beyond repair. The boiler of the right engine was also crushed in to such an extent that the steam escaped. Neither of the locomotives, however, was derailed, although the trucks were torn from their supports and the piston rods and cylinders dismounted as well.

Although the actual speed of the engines at the time of contact cannot be calculated, the force was such that an iron bar weighing 75 pounds, detached from one of the pilots, was thrown 150 feet to one side of the track, and such small pieces as bolts and nuts were found as far away as 300 feet. When the engines were started the whistle valve of each was opened. As soon as they met, the shock shut off the whistle of the left engine, but that of the right continued until steam had been exhausted.

The Committee on Awards of the Louisiana Purchase Exposition, St. Louis, has conferred upon the Wellcome Chemical Research Laboratories the distinction of a grand prize and three gold medals, in recognition of the importance and educational value of the chemical and pharmacognostical researches conducted in these laboratories under the direction of Dr. Frederick B. Power.

The Ninth Satellite of Saturn.

It is probable that, in the future, there will be no difficulty in securing a sufficient number of observations of Phoebe, the ninth satellite of Saturn, not only to correct the present elements, but to study the large and interesting perturbations to which it is subject. It can be observed visually with the largest refractors, and can doubtless be photographed with large reflectors, as well as with the Bruce telescope, by the aid of which Prof. William H. Pickering discovered it. Since the observations enumerated by him in the Harvard Annals, LIII., 55, 60, Phoebe has been closely followed by Prof. Bailey.

For some unexplained reason, Phoebe has not been found on the plates taken in July. The record for the plates taken in August has not yet been received from Arequipa.

A NEW VARIABLE IN HERCULES.

The meridian photometer, like other meridian instruments, is not adapted to the discovery of variable stars. It may therefore be of interest to note the discovery of such an object by the writer, with the 12-inch meridian photometer. On August 23, 1904, while measuring the star + 24 deg. 3419, magn. 9.4, it was noticed that a brighter star, having the photometric magnitude 9.5, and not in the Bonn "Durchmusterung," preceded it. An examination, the next day, of the photographs of this region at once showed that the star was a variable of long period having a range extending at least from the magnitude 9.5 to < 13. The approximate position for 1855 is R.A. 18h. 20m. 26.0s. Dec. + 24 deg. 56.4 min.

EDWARD C. PICKERING.

The French Admiralty have been carrying out prolonged experiments with a new type of accumulator, which it is expected will enable the design of submarine boats capable of attaining a speed of 16 knots an hour. The greatest secrecy is being preserved in regard to the invention. All that is known about it is that it is lighter than any accumulator now in use, and is said to be able to store sufficient energy for propelling engines of 1,000 indicated horse-power at the above speed. At present the accumulators actually in use upon the last completed submarine only yield 250 horse-power and give a speed of 11 knots; the "Emeraude" type of boats will be fitted with 600 horse-power accumulators, giving a speed of 12 knots. The utilization of the latest type of accumulators therefore will mark a great development in submarine propulsion.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

SEWER-LIFT.—G. V. ELLIS, New York, N. Y. This invention comprises a certain novel arrangement by which when the sewage reaches a predetermined level in the reservoir or tank a valve is automatically opened, and by action of steam, air, or other compressed fluid, the contents of the tank will be forced out thereof. In the preferred form of the invention, provision is made for exerting an air pressure directly on the sewage to force it out of the tank and for setting in operation a steam ejector which sucks out the sewage. Either, or indeed both, of these devices may be employed at will.

Electrical Devices.

ELECTRIC AUTOMATIC BLOCK-SIGNAL AND SAFETY SYSTEM.—G. P. FINNIGAN, Greene, N. Y. In this patent the inventor has reference to electric block-signal and safety systems, more particularly for use upon railroads, drawbridges, etc., where it is desired that a moving member shall actuate an alarm adjacent thereto and also actuate an alarm at a distance.

Of Interest to Farmers.

VINE-CUTTER.—F. M. EWELL, Egypt, Wash. Mr. Ewell has invented certain new and useful improvements in vine-cutters, and his invention relates to devices of the above-stated character, the object in view being to simplify and improve cutters as they have heretofore been constructed. The cutter is adapted for cutting strawberry and other vine runners, as also for cutting lawn edges, grass, and other similar uses.

GRAIN-BINDER.—W. C. DURYEA, Blawenburg, N. J. The object of this inventor is to effect certain improvements in the mechanism for actuating the stop and ejector arms of grain-binding apparatus. A further object is to so construct the trip devices that they will be more certain in operation than heretofore.

INSECTICIDE APPARATUS.—O. BERGER, Galveston, Texas. The improvement relates particularly to means applicable for preventing the ravages of the boll-weevil, which infests the cotton plant; but the said method and means may be applied also to prevent the injury of vegetable growths by other forms of insects and also by diseases. The composition which is harmful or destructive, is inclosed in a tube having lateral perforations and adapted to be inserted in the body or root of a plant.

COVER FOR DAIRY PRODUCTS.—O. THIBAULT, Fall River, Mass. In this case the invention relates to improvements in covers for incasing cheese, butter, etc., the object being to provide a device of this character that will fully protect the products from dust and dirt when lowered and having a means for refrigeration during warm weather and also having a simple means for raising and lowering the cover.

FENCE-POST.—N. A. FJELD, Joice, Iowa. In this patent the invention is an improvement in posts designed especially for use as an anchor or corner post for barb or woven wire fences. In practice the parts of the post may be made of iron and will present a strong, durable construction.

Of General Interest.

SPIRIT-LEVEL.—J. BISHOP, Bartow, Fla. The invention relates to improvements in levels; and the object the inventor has in view is the provision of an improved spirit-level in which the contradistiuction between the tube and the liquid within shall be so clear that the air bubble present in levels of this type may be readily seen in a very poor or dim light and at a reasonable distance.

ROOT-EXTRACTING FORCEPS.—N. D. ASDELL, San Francisco, Cal. This improvement consists in forming the adjacent faces of the screw-threaded and longitudinally-divided beak with a longitudinal or intermeshing rabbet, so that the two sections of the tapering and screw-threaded sections will not slip or twist upon each other when rotated upon a longitudinal axis, but will, on the other hand, mutually brace each other and hold together, so that the beak may be tightly seated in the root-cavity. It also consists in means for maintaining the tight grip of the two halves of the beak while extracting the root.

HEAT-INSULATING COMPOUND.—J. D. SCOTT, Shields, England. This invention relates to a compound useful in various connections, but especially intended as a covering for boilers, steam-pipes, and equivalent structures to prevent loss of heat by radiation. The compound is composed of asbestos and mica with a starch-like bonding, enabling the compound to be prepared in plastic form and spread over the surface to which it is applied, after which it sets permanently to the surface.

TUNNEL CONSTRUCTION.—P. KAMMERER, New York, N. Y. One purpose in this instance is to provide a construction made up of a series of angle-irons braced and arranged for reception of cementing material and for interlocking connections, which sections are finished by a plastic covering or shell and filling before fitted to place, and also provide a coupling for opposing sections which will join them, the couplings so constructed that the cementing material can be introduced from a point above parts being fitted, so as to make the structure concrete or integral and waterproof and so that particles, such as sand, cannot find ingress to the tunnel structure.

GEOMETRICAL INSTRUMENT.—S. E. LLONA, Lima, Peru. In carrying out this improvement the inventor has in view providing an instrument which shall be simple in construction and manufactured in large quantities at small expense. He provides an instrument which enables mathematicians, engineers, draftsmen, and those engaged in like professions to divide and subdivide angles into any number of parts with exactness and accuracy and also rectify circles or parts of circles.

CLASP FOR SUPPORTING SCARFS FOR NECKWEAR.—LETTIE LASSEN, New York, N. Y. The object in this case is to provide a simple clasp that may be readily applied upon a wide ribbon or other flimsy fabric used as neckwear or for other purposes where it is available and hold such fabric from becoming wrinkled or drawn into folds that reduce the width of the ribbon and render it bulky, uncomfortable, and unsightly as an article of ornamental neckwear.

HORSESHOEING-STAND.—S. M. MARTIN, Sidney, Ohio. The invention refers more especially to the type of stands described and illustrated in Mr. Martin's former Letters Patent. A structure is preferably employed comprising uprights, from the upper part of which extend parallel longitudinal beams, across which are disposed supports for the upper ends of laterally swinging racks, between which latter the animal stands during the shoeing operation. Specially-constructed devices are used to hold the racks to any position. Other details are also employed.

GARMENT-FASTENER.—F. SMITH, Council Bluffs, Iowa. The prime object of the invention is to provide a device in which the two parts of the fastener may be readily engaged with each other and when so engaged will not be liable to accidental disconnection and which will allow a large freedom of movement between the two fastener parts without endangering the disconnection. This fastener is useful in connection with cloths and garments of various sorts, particularly the garments of women and children.

ARTIFICIAL LIMB.—S. E. STAGGS, New York, N. Y. In the present instance the inventor contemplates as the main object the provision of an upper leg member, a knee joint, a lower leg member, an ankle-joint, and a foot member, these parts all being designed to be correlated and arranged. There are means for adjusting and controlling the tension of the knee joint in such a manner that the latter may be suited to various conditions. The ankle connection of the limb is so constructed that freedom of movement will be at all times secured, while a safe, comfortable joint will be attained.

FLUE-STOPPER.—L. RUSSELL, Carthage, Ill. The object of this improvement is to provide a stopper which shall be adapted to be easily inserted in and removed from a flue or thimble and which will close the latter tightly when duly secured in place, and thereby exclude dust, dirt, or soot from a room in which the flue is located.

EYE-BRUSH.—C. F. W. RAMUS, East Boston, Mass. The inventor's object is to provide a simple device, quite small and portable, that may be readily applied for the removal of foreign matter from the human eye by the one afflicted or by another person and that will quickly remove the foreign matter without the slightest injury to or further irritation to the eye.

MUFFLER.—S. HUGHES, Randolph, Wis. The purpose in this case is to provide a collar and muffler with a shirt-front and necktie effect which can be attached to a chest-protector, sweater, or shirt, and worn to cover the face with the exception of the nose and eyes so as to cover the mouth and nose as well and which may be worn to provide a warm collar practically reaching to the chin, with or without ear-protectors, the latter being normally attached to the rear of the collar or skirt section of the muffler.

EGG SCOOP.—J. SCRIMGEOUR, JR., and J. OBERDORFER, Pittston, Pa. In this patent the invention relates to improvements in scoops for transferring eggs from a crate to an egg-tester and back to the crate, the object being to provide a scoop of inexpensive construction and by means of which the eggs may be readily removed in layers from a crate without danger of breaking the eggs.

PHOTOGRAPHIC-PLATE HOLDER.—J. SCHAUB, Logan, Utah. One of Mr. Schaub's improvements resides in a device located in the plate-chamber by which a plate can be easily and quickly inserted or removed without touching the sensitized surface thereof, such device serving also as a means for locking the plate against movement when fully inserted and tending to prevent accidental dropping of the plate during the manipulation of the holder in inserting or removing plate. Another improvement is a form of light-excluding flap, and another, a type of slide-lock adapted to retain the slide in its closed position and serving as a handle for withdrawal of slide.

BOTTLE-BRUSH.—L. J. WIDNESS, New York, N. Y. In this instance the object is to provide a new and improved bottle-brush arranged to permit the operator to conveniently, quickly, and thoroughly clean the inner faces of the sides and bottom of the wall of a bottle simultaneously and without much physical exertion on the part of the operator.

RULER.—P. CUMMING, Key West, Fla. In this patent the invention relates to parallel or other rulers, and is especially adapted to that class of parallel rulers that are used by sailors for laying out courses, plotting their daily work, and the like. It is, however, of general use on rulers and not confined to parallel rulers. The improvement increases ease of operation of rulers, prevents their slipping, etc.

GAS-WASHER.—F. BURGEMEISTER, Celle, Hanover, Germany. The invention is mainly intended to replace scrubbers used in the manufacture of illuminating gas, in which hurdles, sheet-metal trays, coke, etc., are usually employed for freeing gas flowing through from tar and ammonia. Washers are known in which subdivision of water-supply is effected by means of sieves, plates, or revolving vanes. These, however, operate with large quantities of water and partly with considerable motor power, and very expensive. The present washer insures purification of gases by a peculiar arrangement for spraying the liquid.

BOTTLE-CLEANING DEVICE.—W. W. SPALDING, New York, N. Y.. The object of the improvement is the provision of a cleaning device more especially designed for cleaning nursing-bottles and the like, by the use of shot and arranged to allow of conveniently placing the shot in the bottle, confining it therein while shaking the bottle, and allowing quick removal and storing of the shot after the bottle is cleaned.

DISPLAY CASE OR RACK.—L. M. SIERSDORFER, Carrollton, Ky. The purpose of the invention is to provide a case or rack for hats, neckwear, or other merchandise which will occupy as little room as or less room than a counter, and which will display a far greater quantity of goods to much greater advantage. The device can be quickly and conveniently taken down or set up, all of the body portion when the parts are separated fitting into the base with the exception of the top, which can be used as a cover for the other parts.

FIREARM.—E. E. REDFIELD, Glendale, Ore. This arm is so constructed that after a shot is fired and the thumb-lever connected with the breech-block, and which acts as a trigger-guard, has been carried forward the block is carried rearward and the cartridge-carrier is brought into position to receive a cartridge from the magazine, clamping cartridge and holding it, and as the lever is restored to guard position relative to trigger, the carrier is elevated to bring cartridge in alinement with barrel and the block is brought forward to force the cartridge into firing position, the carrier meanwhile dropping downward out of way of block to position close to back of magazine, the grip of the carrier being opened to receive cartridge when lever is carried forward.

FEED-BOX.—W. G. HAAS, New York, N. Y. This invention relates to feed-boxes for horses and other animals, and is especially adapted for use in fire-stations for feeding horses liable to be called out at any time. The principal object is to do away with the use of objectionable portable feed-boxes and also to do away with the necessity of putting the feed on the floor.

PAPER BOX.—J. T. CRAW, Jersey City, N. J. The purpose in this improvement is to provide a box which may be quickly and conveniently set up and which when set up will have a perfectly flat, springless bottom, without exposed folds, the blank from which the box is made being economically cut, and so cut and scored that when the parts are adjusted to place they will be, as it were, locked against displacement without the aid of paste or other viscid material, except at one edge of the body of the box.

JEWELRY-FASTENING DEVICE.—R. FISCHER, New York, N. Y. The principal object of the invention is to provide a device which is small, simple, and inexpensive, which may be quickly applied to a scarf-pin and when so applied will automatically grip the pin, so as to hold it securely and prevent its accidental removal from the garment in which it is inserted.

VALVE-CONTROLLING DEVICE.—A. F. DONALDSON, Mansfield, Ohio. The invention relates to means for controlling valves to govern the amount of water or other liquid passing through the valve. The object is to provide a device simple and durable in construction, easily adjusted, and arranged to insure a rapid closing of the valve after the desired amount of liquid has passed through the valve.

CLASP FOR GARMENT-SUPPORTERS.—J. C. DOWNEY, Waterbury, Conn. In the present instance the intention is to provide novel details of construction for a clasp that adapts it for very effective service as a means for detachably connecting the leg of a stocking with an elastic band used as a stocking-supporter, but which may also be used in connection with other garment-supporters.

Hardware.

DOOR-HANGER.—J. CRAMER, Lima, Ohio. Among other objects the invention seeks to provide a construction wherein the door may be easily adjusted without tearing away the woodwork, the parts are not liable to get out of order when properly installed and adjusted, the wheels run truly and practically noiselessly on the track, the wheels cannot jump the track by a sudden jolt, sidewise movement is minimized, it is not necessary to leave wide space or opening in head-jamb for travel of the hanger, and the parts are easily placed in position.

BRACKET.—G. W. CAMPBELL and A. C. WILLIAMS, Chattanooga, Tenn. The Messrs. Campbell and Williams's invention has reference to improvements in metal brackets, particularly for supporting metal sinks and the like, an object being to provide a bracket that may be readily adjusted to sinks of different widths, and by the use of which drilling of holes in the sink-rim is obviated. The bracket is equally adapted for supporting shelving.

WRENCH.—H. STEIN, Georgetown, Minn. This improvement relates to a class of lever-wrenches having a fixed jaw, a slidable jaw, and means for holding the slidable jaw at a desired distance from the fixed jaw. The object is to provide details of construction for a wrench which adapt the wrench for very convenient adjustment of the slidable jaw and enable the instant fixture of the movable jaw at a desired point on the lever-bar of the wrench.

Heating and Lighting.

ARC-LIGHT DISTRIBUTER.—H. J. PALMER, New York, N. Y. In Mr. Palmer's patent the invention has reference to means for distributing light and admits of general use, but is particularly applicable in the case of arc-lights, for the reason that in such lights the illuminating-surface due to the use of carbon is comparatively small.

ATTACHMENT FOR FIRE-BOXES OF STOVES.—A. MARKOFF, Derby, Conn. Means are offered in this invention for changing the dimensions of the fire-box, so that more or less fuel may be consumed and the heat controlled to suit requirements of service. The object is to provide details of construction, simple and readily applied to new or old stoves and that will enable the reduction of the grate and fire-box area any degree, and which by easy adjustment will permit the grate to receive rocking adjustment as may be required.

Household Utilities.

SHADE-BRACKET HOLDER.—H. G. FILSON, New Cumberland, W. Va. This device is adapted to be secured to a window-frame and has means for attaching thereto the usual form of bracket used to support a shade fixture. The object is to provide a form of holder to be permanently attached to the window-casing, to which holder the usual form of shade-bracket can be removably secured in a number of positions of adjustment.

EXTENSION-TABLE.—A. F. ZOCHERT, Fond du Lac, Wis. The improvement is particularly in that class of tables having a "pedestal" formed in sections connected with opposite ends of the table and arranged when extension-leaves are removed and the table is closed to inclose a central leg; and the object is to provide constructions for locking together the sections of pedestal when the extension-leaves are removed and table closed.

Machines and Mechanical Devices.

OILER FOR SHAFT-BEARINGS.—W. M. COFFMAN, Madison, Wis. The invention relates particularly to improvements in automatic oilers for vertical shaft-bearings. The object is to provide an oiler of simple and inexpensive construction that will provide a continuous supply of oil whether the shaft be running fast or slow, and the arrangement is such that the surplus of oil will flow back to the reservoir to be used over again.

THREAD HOLDER AND CUTTER FOR SEWING-MACHINES.—C. D. MATTHEWS, New Orleans, La. The invention relates to a device applied to the presser-foot of a sewing-machine for holding the end of the needle thread, and for cutting off the same after the stitch has been finished. It comprises a spring tongue to hold the thread against the presser-foot and against which the blade is drawn to cut the thread.

FRICTION-CLUTCH.—C. J. MACOMBER and G. H. GUTHRIE, Muncie, Ind. An improved friction-clutch has been invented by Messrs. Macomber and Guthrie, which is simple and durable in construction, very effective when in use, and arranged to insure an easy running of the pulley when not in frictional contact with the clutch members. It also allows the positive driving of the pulley and shafts when the clutch is in action.

THREAD-CUTTER FOR SEWING-MACHINES.—C. D. MATTHEWS, New Orleans, La. The device comprises the combination with the needle or throat plate of the sewing-machine, of a tongue fastened thereto, and having a cutting edge, this tongue serving both to pinch the end of the thread against the throat plate, and also to cut off or sever the thread so that after the seam has been made, the sewed fabric may be readily detached from the machine.

CLUTCH.—E. DYSTERUD, Monterey, Mexico. The inventor seeks to provide means for more accurately and fully adjusting the parts of the clutch, thereby insuring absolute accuracy and positive action. By this means the action of the clutch is kept back until the motive-power

machine has attained full speed, and then the clutch takes hold of the loaded pulley.

MULTICOLOR PRINTING PRESS.—F. E. KEMPF, care of Joseph Baron, 333 West 16th Street, New York, N. Y. The object of Mr. Kempf's invention is to provide an improved multicolor-printing press designed to permit printing in any desired number of colors on one or both sides of the sheet and arranged to allow quick adjustment of the several parts to enable the operator to conveniently and easily "make ready" and insure perfect impressions. The machine is also applicable to the printing of wall papers, textile and oil cloths.

MUSIC-LEAF TURNER.—J. W. O'NEEL and J. R. EDWARDS, Lafayette, Ore. The turner is of that class in which a number of wings intended to be attached, respectively, to the music-leaves are arranged to be turned in succession by operating devices actuated either from the operator's hands or feet. The principal novelty lies in the manner of mounting and successively operating the wings and in the devices for returning any one or all of the wings either to repeat a part or the whole of the music or to place the apparatus in position for renewed operation of any sort.

METALLIC PACKING.—J. JACOBSON, Lead, S. D. This invention relates to packing for rods that are members of steam and other engines, and has for its object to provide features of construction for metallic packing, which adapt it for very effective service, enable the convenient inspection or renewal of interior details when worn so as to require it, and that permit the application of lubricant through the packing and upon the rod packed therewith.

CAKE-MIXING MACHINE.—JULIA C. GAUTIER, Columbus, Ga. The object of this invention is to produce a machine in which batters for making cakes, etc., can be quickly and easily formed and in which the whites and yolks of eggs and butter which are used in making these batters can be separately beaten at one and the same time by one person.

PNEUMATIC LEAF-TURNER.—J. W. ALBIN, Babylon, and L. A. SEAMAN, Mineola, N. Y. In this patent the invention of Messrs. Albin and Seaman relates to leaf-turners, and more particularly to the kind used in connection with sheet-music, their more particular object being the production of means for operating the same pneumatically by the pressure of the operator's foot.

HAT-MACHINE.—G. W. CHAMBERLAIN, Atlanta, Ga. The invention relates to improvements in machines for forming bell-crowned hats of felt or similar material, an object being to provide a machine by means of which bell-crowns may be quickly and uniformly pressed into shape without danger of tearing the hat material.

CARTRIDGE-LOADER.—E. E. BRECKENRIDGE, Manning, Iowa. The invention comprises a comparted hopper with measuring devices for withdrawing the charge of powder and shot therefrom and discharging the same into the cartridge-holder, which is sectional to engage and release the cartridge and which is so positioned that the rammer, which is located above the holder, may be moved down into the same to ram the charge and wads in place.

SPLIT PULLEY.—G. F. MCLYNN, Cottagegrove, Ore. In the use of this efficient device the sections are placed about the shaft in the usual manner, with a bushing of proper size interposed, and then clamped upon it by bolts, a sectional bushing used if desired to secure engagement. When fixed in place, it will be seen that the strain upon all parts of the rim is communicated directly to the shaft and at places where the structure is weakest, this being at the juncture of the sections, a double support is given.

STIRRING APPARATUS.—J. S. DEAL, Monroe, Wis. In the present case the invention relates to apparatus used in the manufacture of cheese; and its object is to provide an apparatus more especially designed for stirring milk in the cheese-kettle and arranged to allow of moving the kettle over or off the fire without interruption of the stirring process.

TRANSMISSION-GEAR.—C. H. DAY, Hornellsville, N. Y. The mechanism consists of a gearing of the sun-and-planet type, whose principal feature lies in the arrangement by which the planetary gears are carried bodily by the driving member and moved continuously around the axis thereof, high speed being attained by locking the gearing and low speed and reverse being attained by coacting gears of varying ratio.

PUMP-COUPLING.—C. W. DECKER, Charles City, Iowa. The object in this improvement is to provide a construction for coupling the pump-handle to the pump-rod and at the same time uncoupling the windmill-rod from the pump-rod, and *vice versa*, by the movement of pump handle or lever and to so construct the parts that they may be easily and quickly attached to any ordinary windmill-pump by means of a wrench and file.

Prime Movers and Their Accessories.

WINDMILL-LUBRICATOR.—H. H. TATSCH, Fredericksburg, Texas. An object of this invention is the provision of a lubricator adapted at predetermined times to supply a lubricant to a receptacle, from which receptacle ducts lead off the lubricant to the portions of the windmill to be subjected to lubricating process. Lubricating operation will not take place until certain mechanism actuated from the mill-pitman is brought into operation to supply the receptacle, referred to, with the lubricant. There is no possibility of dust, snow, ice, or the like clogging or interfering with the operation of the parts.

ENGINE.—O. P. UNDERWOOD, Central City, Neb. The invention relates to multicylinder-engines. The object is to provide an improved engine which is simple and durable in construction, very effective in operation, and arranged to utilize the motive agent to the fullest advantage to insure a uniform and constant transmission of the power developed to the main shaft at all points of the latter's rotation and completely avoid dead-center positions.

WINDMILL.—T. O. PERRY, Chicago, Ill. Of objects in this case, one provides for automatically changing the weather angles of sails from positions suited to easily starting motion to other angles better suited to efficiency after the wheel gains motion and, vice versa, to provide for having sails automatically assume better weather angles for starting motion whenever the motion of the wheel ceases or is unduly retarded; another, provides further automatic regulation of weather angles of sails for preventing excess motion in high velocity winds, or for maintaining motion not to exceed desired maximum in any wind.

Pertaining to Vehicles.

ADVERTISING-VEHICLE.—J. A. ELDRED, New York, N. Y. The object of this invention is to provide an improved advertising vehicle having fixed and movable advertisements to readily attract the attention of the public while the vehicle passes along the highways. The body of the vehicle comprises a number of advertising panels between which mirrors are placed. Two large spheres are placed in the upper part of the vehicle which carry advertisements and are slowly rotated as the vehicle moves along.

VEHICLE.—J. A. WILLIAMS, Cleveland, Ohio. In this patent the invention relates to vehicles, and more particularly to the axle of those of the motor-driven type. Its principal objects are to provide a simple and durable arrangement whereby the driving power may be applied to the axle of the steering-wheels. Mr. Williams has made another invention relating to vehicles, it being particularly applicable to those propelled by motors. It has for its principal objects the provision of means for connecting to the same supporting-wheels both the vehicle steering and driving mechanism.

RATCHET-LEVER.—H. W. KOEHLER, Oswego, Ore. In this case the invention has reference to novel features of construction and arrangement residing in a ratchet-lever and ratchet, by means of which a suitable leverage may be exerted on the ratchet, and the dog or pawl must automatically disengage the ratchet upon the reverse movement of the lever.

DOUBLE-TUBE TIRE.—F. F. THOMPSON, Lawton, Oklahoma. The design of this invention is to overcome many difficulties in a simple and practical way. To that end it consists in locating the valve-hole of the outer tire at a distance beyond the slit, so that said hole is not bisected on one side of the slit; but the hole has a solid collar of the outer tube material all around the valve hole, forming an unbroken reinforce for the valve-nipple, so that there is no bulging of the inner tube on one side of valve immediately adjacent thereto and difficulties are entirely obviated.

Railways and Their Accessories.

SLEET-CUTTER AND CONTACT FOR ELECTRIC RAILWAYS.—C. T. LEONARD, Leonardo, N. J. The invention relates to improvements in a conductor-contact and sleet-cutter for electric railways, the same being more especially adapted for use in connection with the third rail of an electric railway system, although some features may be used on overhead electric conductors and in other railways. It provides a contrivance for insuring good electrical contact with a conductor-rail and for rapidly and thoroughly cutting sleet adhering to the head of such rail. It provides means for clearing away ice and sleet, so that good electrical contact may be secured between rail and contact and cutter wheel, and furthermore, to yieldably hold parts under pressure in working positions.

CAR-FENDER.—W. T. WATSON, Newark, N. J. The invention has reference to an improved fender, which is arranged automatically to assume a basket-like form upon a person falling into the fender, so that in this manner the fallen person will be held safely until the car is stopped and the person removed from the fender.

Designs.

DESIGN FOR A CUP.—J. A. MOLLER, JR., New York, N. Y. In this ornamental design the invention presents a ball-shaped cup, near the top of which is a round rim opening. Two gracefully-poised cattle horns connect with the sides of the cup at its center with the bottom of the base holding up the bowl portion of the cup.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6162.—For a good, low-priced telephone for plantation use.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 6163.—For a hand-power press for printing trade-mark on orange boxes.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6164.—For a salmon-colored newspaper 11½ x 44 inches, with or without lace ends, for lining orange crates.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6165.—For embossed paper or metal cards for advertising fruit.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6166.—For pressed paper imitating tiling and pressed steel ceiling for use over plain wood ceiling.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 6167.—For ¼ h. p. gasoline engine castings for amateurs.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6168.—For manufacturers and printers of manila tissue fruit wraps.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6169.—For manufacturers of sheet and wrought bar brass.

All Manufacturers.—See advertisement in last week's paper, page 324, of improved bicycle. Easiest of terms. A. A. Kennedy, Overbrook, Pa.

Inquiry No. 6170.—For manufacturers of tarred wooden tube wrapped with wire or iron.

DRY BATTERIES.—How to make and use them. Practical, with original drawings. Mailed for 25 cents. Spon & Chamberlain, 123 S Liberty Street, New York.

Inquiry No. 6171.—For a tool grinding outfit attached to a bicycle, so arranged that the bicycle pedales may be used in propelling.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 6172.—For makers of light, portable emery grinding machines.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6173.—For manufacturers of ball and socket fasteners.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6174.—For makers of square and flat wire in sizes up to ¼ inch.

We manufacture gasoline motor and high-grade machinery, castings best quality gray iron. Select patterns, and let us quote prices. Frontier Iron Works, Buffalo, N. Y.

Inquiry No. 6175.—For makers of wire paper clips.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6176.—For makers of motor cycle engine castings and accessories.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 6177.—For machines for beveling the edges of cardboards.

Special Machinery to order, manufacturing, metal stampings, etc., Brickner Machine Co., Tiffin, Ohio.

Inquiry No. 6178.—For manufacturers of ink for inking typewriter ribbons.

WANTED.—Gasoline engine to build on royalty arrangement, or would buy. Chicago machinery manufacturing house. Engine must be practical, powerful, and adaptable mainly to small runabout automobiles. Address Machinery, Box 773, New York.

Inquiry No. 6179.—For the present manufacturers of the Merrill pump, lately of 120 Broadway, New York city, or repair parts for these pumps.

Inquiry No. 6180.—Wanted, to purchase outright a patent, or the manufacturing right of some small, light, mailable article, of general utility and attractiveness.

Inquiry No. 6181.—For makers of a machine for manufacturing wheat starch.

Inquiry No. 6182.—For builders of two-story rustic cottages with the bark on.

Inquiry No. 6183.—For makers of tin strips 2 inches wide, any length.

Inquiry No. 6184.—For parties to manufacture spatulas on paid contract.

Inquiry No. 6185.—For dealers in small hand power ice machines.

Inquiry No. 6186.—For parties to make patented cuff holders on contract.

Inquiry No. 6187.—For manufacturers who make igniter or electrode points in special shapes.

Inquiry No. 6188.—For manufacturers of a furnace regulator—automatic device to regulate draft and check damper.

Inquiry No. 6189.—For a small toy caloric engine.

Inquiry No. 6190.—For an automatic dice box with glass top, working by lever.

Inquiry No. 6191.—For a small kiln, new construction, where lime does not come in contact with fuel.

Inquiry No. 6192.—For makers of castings of auto engines, ¾ h. p., and dynamos about 8 lights.

Inquiry No. 6193.—For makers of wooden staves for straight-sided tubs, fiber board.

Inquiry No. 6194.—For makers of rotary ticket-cutting machines, pasteboard-making machinery, machines for coloring tickets, also for printing them, etc., of simplest construction.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9476) C. T. J. asks: 1. I have a book which tells how to construct induction coils, but the different sizes of wire to be used are all given in the English standard wire gage. Is there any way in which I could find out the corresponding number (size) of wire in the American, or B. & S. wire gage? For instance, number 30 English standard wire gage would be what number (or size) in the B. & S. (American) wire gage? A. Any book of tables for mechanics should contain the sizes of wires given both in the American and the British systems. Most school text books of physics contain them, also many catalogues of dealers in electrical supplies. These last can be had free by inclosing a stamp to these houses. No. 30 wire British gage is .012 inch in diameter. It is between No. 28 and 29 American gage, nearer No. 28. For the small wires, no great error will be made by using a wire one or two numbers lower in American gage. That is, the British wire is thicker than the American wire of the same number. 2. I have one of those small vest-pocket electric flashlights, the dry cell of which is nearly run down. Please state the voltage and amperage of the current most suitable for recharging the cell, if that can be done. A. A small dry cell should be recharged with about 2 volts and 3 or 4 amperes. It is very much cheaper to throw the run-down cell away and buy new, for a recharged cell is worth no more than half as much as a new one. 3. In the above question, how can a person tell when the cell is fully recharged, and about what length of time is necessary to carry on the recharging process? A. A dry cell should be charged till the voltmeter indicates 1.5 volts at its terminals. We cannot say how long it will require. 4. I have a small Ajax (toy) motor that will run on one cell dry battery. How many ohms resistance would it be necessary to connect in series with it so as to run it on a 110-volt direct current circuit? A. The amount of resistance required for a toy motor on a 110-volt direct current circuit cannot be told without knowing the resistance of the motor. As this is doubtless low, it will be safe to use 250 to 300 ohms. 5. How many 16 candle power, 110-volt incandescent lamps would it require to be connected in series with the above motor to obtain the required resistance? A. Try the motor in series with two 16 candle power 110-volt incandescent lamps, and if it does not come up to speed take out one of them. If it runs too fast add lamps. 6. Is there any better way of getting the above resistance so that the motor will run on the 110-volt circuit safely? A. There is no simpler resistance than that of a lamp bank, nor any more commonly used for experimental purposes. A water rheostat will answer equally well. 7. Would a 110-volt alternating current require any more or less resistance for the motor than the direct current circuit, and if so, how much? Would it run the motor all right, or just as well as the direct current? I mean the alternating current with the necessary resistance. A. An alternating current generally requires less resistance, if the coils are wound in spools, or inductively, than is required by the direct current. How much less cannot be told without full data. A direct-current motor may be run on a single-phase alternating current, but it is not self-starting. The motor must first be brought up to full speed and the current then turned on. 8. Kindly state the safe (allowable) carrying capacity, in amperes, of numbers 14, 12, 10 and 8 rubber-covered wire, respectively, on 110-volt circuits. A. The carrying capacity of rubber-covered wires by the tables of the underwriters is as follows, all systems and voltages: No. 1, 14 amperes; No. 12, 17; No. 10, 24; No. 8, 33.

(9477) J. A. C. asks: The question is often asked: How much voltage does a current of electricity have to have to kill the average man? I was of the impression that it depended on a good many other things as well as voltage, and that sometimes an extremely high voltage was harmless, as the current from a Wimshurst machine or induction coil. My friends tell me, though, that anything over two or three thousand is certain death. Have you any data as to the resistance of the human body? A. The amperes of electric current which can flow through the human body depends

upon the resistance of the body, and that varies largely with the dryness of the skin. It may be 10,000 ohms when the skin is dry, and 300 ohms when it is moistened by potash, as is the case in executing criminals by electricity. "A current of as much as twenty thousandths of an ampere will produce strong muscular contractions, and a current of two amperes traversing a vital part is certainly fatal." (Thompson.) The ordinary current used in medical practice is from two to ten thousandths of an ampere. The current from a Wimshurst machine is very minute. Taking the average resistance of the human body at 2,500 ohms, a pressure of 500 volts will send a very disagreeable amount of current through a man; 2,000 to 3,000 volts alternating would be certainly fatal, if it traversed the head or spinal column. This effect is due either to the shock upon the nerves or to the destruction of the tissues by burning or electrolysis, the blood being coagulated. In the latter case there is no possible restoration. It is obvious from this that it is the amperes and not the volts which do the injury. The volts only furnish the pressure to cause the current or the amperes to flow.

(9478) H. A. T. asks whether the inside or outside wheels of an automobile have a tendency to lift or rise from the ground when the machine makes a turn or curve. A. The inside wheels.

NEW BOOKS, ETC.

DOMESTIC MANNERS OF AMERICANS. By Frances Trollope.

LIFE OF JESUS. By Ernest Renan.

NATIONAL DOCUMENTS.

STUDY OF WORDS. By Richard C. Trench.

Unit Books. Published by Howard Wilford Bell, 259 Fifth Avenue, New York, 1904.

We already have had occasion to comment upon the excellence of Mr. Bell's unit books—books which are sold by the number of pages that they contain, at one cent the unit of 25 pages. The four volumes before us represent most important additions to his admirably selected list.

Trench's "Study of Words," although it does not represent what might be considered modern philological views, has been the basis of many a work of similar character. The recent investigations conducted have disposed rather summarily of many of Trench's etymologies. Still, his book, written in a graceful though academic style, is just as readable today as it was in 1851.

The volume of National Documents is "a collection of state papers so arranged as to illustrate the growth of our country from 1606 to the present day." It includes the first charter of Virginia, 1606; the "Mayflower" contract of 1620; Articles of Confederation of the New England Colonies, 1643; typical early Indian treaties of 1645; Declaration of the First Continental Congress, Declaration of Independence, Articles of Confederation, Treaties, and the Constitution of the United States.

Of Ernest Renan's "Life of Jesus," suffice it to say that in its present form the book makes an attractive volume.

The Unit books are so cheaply and yet so attractively designed, that the success of the enterprise may be considered assured. As we have already stated, we trust that Mr. Bell will publish a few classic scientific works in the series.

THE STEEL SQUARE POCKET BOOK. By Dwight L. Stoddard. New York: Industrial Publication Company, 1904. 32mo.; pp. 109; 112 diagrams. Price, 50 cents.

This tiny book was written by one skilled in the art of carpentry, for the use of carpenters and mechanics who have to do with the square in their daily work. It is brimful of all sorts of problems met in practical work, and the solution of these problems is made clear by numerous diagrams.

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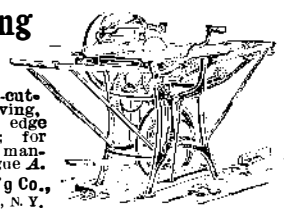

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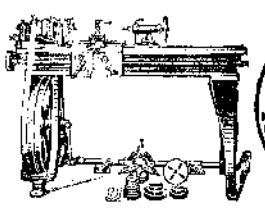

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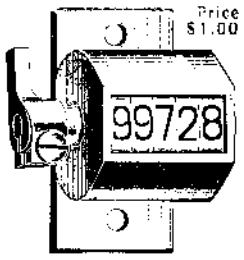

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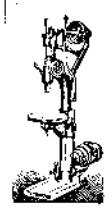

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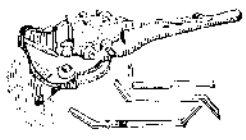

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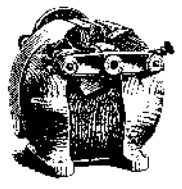

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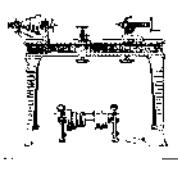

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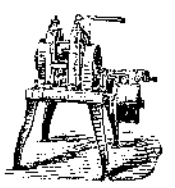

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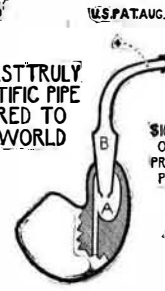

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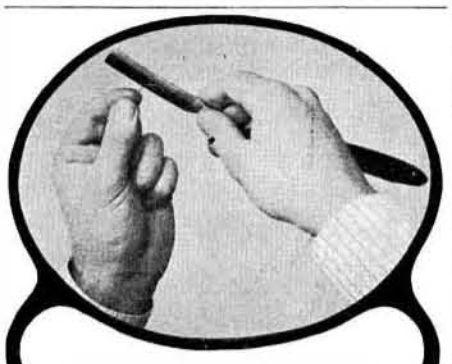

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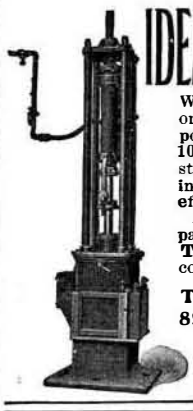

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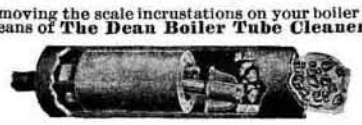

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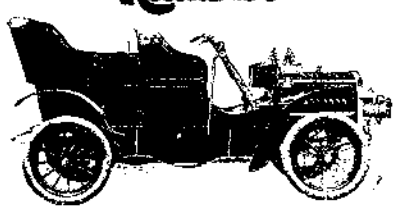

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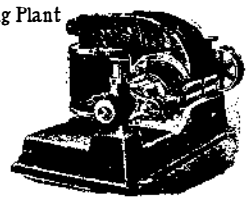

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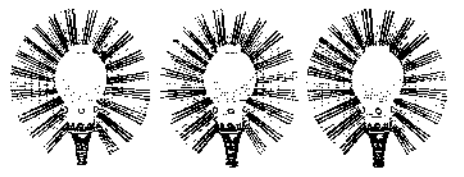

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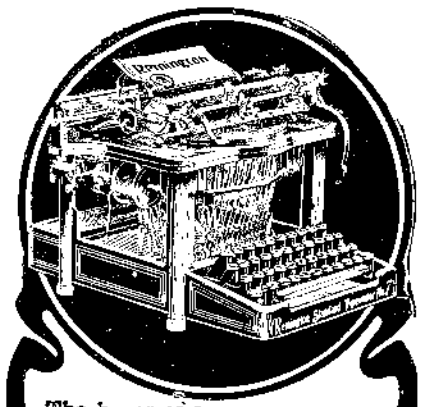

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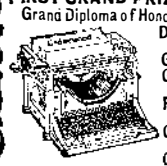

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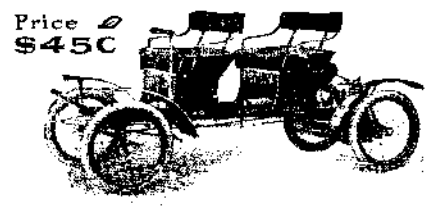

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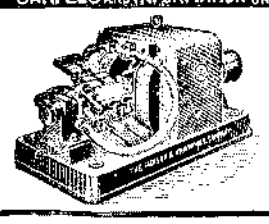

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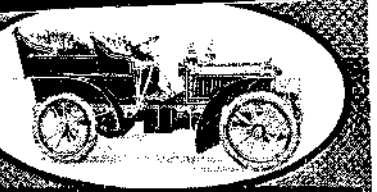

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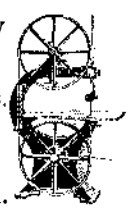

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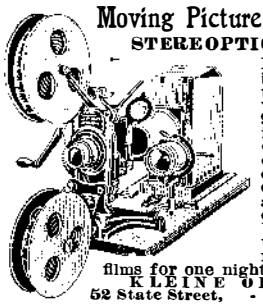

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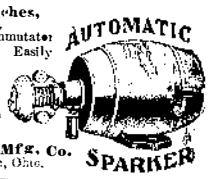

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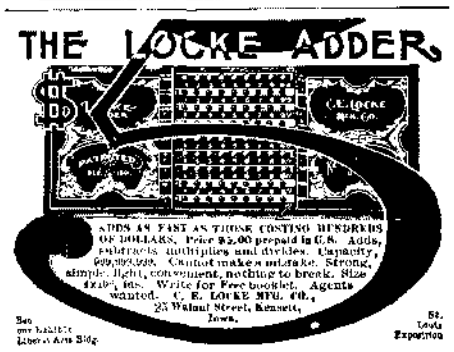

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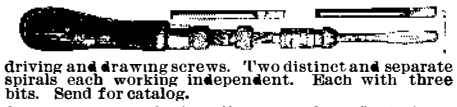

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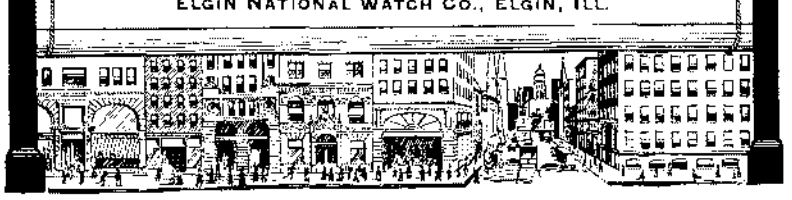

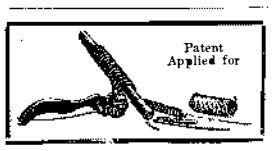

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